nature unleashed

the untamed world of missouri ponds, forests and prairies

MDC DISCOVER nature SCHOOLS

An entire population of Missouri Department of Conservation employees and outside contributors made this project possible. We appreciate the time, effort and expertise that each of these human organisms dedicated to unleashing nature into the lives of students.

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student guide

Serving nature and you®

Missouri Department of Conservation

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1 it's all connected

The world is filled with **living things** and **non-living things**. Plants and animals are living things. Plants need air, water, light, nutrients, space and temperature to survive. Animals need air, food, water, shelter and space. Living things are able to reproduce and create more of themselves. Non-living things do not grow or reproduce.

organism

A single living thing is called an **organism**. An organism is capable of growing and reproducing. A dandelion, a tree, an insect, a frog, a fish, a coyote, a boy and a girl are a few examples of organisms.

Dragonfly

Cattail

Leopard frog

it's not alive!

The world is also filled with non-living things. Non-living things are not made up of living cells. A non-living thing cannot grow or create more of itself or reproduce. Sunlight, air, rocks, temperature, water and landforms (hills, valleys, mountains) are all examples of non-living things that are not alive but are important for survival of organisms.

Organisms also need soil to survive. Soil is made from tiny pieces of broken rock (non-living) and small bits of dead plants and animals (living). Soil also has water and air (non-living). Living things (some too small to see without a microscope) live in soil.

Cottontail rabbits are able to reproduce when they're about 5 months old.

A dandelion is one organism with many tiny flowers bunched together. After a dandelion blooms, each of its tiny flowers produces a seed.

A human is an organism. Populations of humans can be found nearly everywhere in the world.

population

A group of the same organisms living together in the same place and at the same time forms a **population**. One leopard frog is an organism. All the leopard frogs living in and around the same pond form a population of leopard frogs.

Each fish is an organism. All the different kinds of fish living in the same pond form different populations of fish.

Each kind of plant living in or at the edge of the pond is an organism. All the species of plants living in and around the pond form different populations of plants.

community

A **community** is a group of different populations of organisms. All the organisms must live in the same place and at the same time to form a community. All the different populations of plants and animals (duckweed, cattails, dragonflies, frogs) living in and around a pond form a pond community.

ecosystem

All the populations of plant and animal organisms living together in communities interact with each other, or act on each other, and with the non-living things in their environment. An **environment** is the immediate area around a plant or animal. Living and non-living things that interact in an environment form an **ecosystem**.

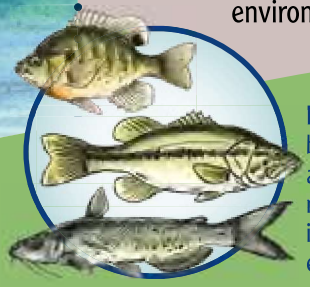
summary

Organism—a single living thing

Population—a group of the same organisms living together

Community—different populations of organisms living together

Non-living things *interact with* Ecosystem



Populations of bluegill, bass and catfish may be found in many pond ecosystems.

Dragonfly populations play an important role in an ecosystem by eating large numbers of insects.

Female white-tailed deer give birth to one, two or sometimes three spotted young called fawns.

2 it's what's inside that counts

Ecosystems differ depending on the living and non-living things within them and how those things interact with each other. Ecosystems supply organisms with the specific food, water, shelter, air and space they need to survive. In this chapter, you will learn about the different plants, animals and non-living things in three ecosystems found in Missouri—ponds, forests and prairies.

pond ecosystem

Don't be fooled by the quiet, peaceful appearance of a Missouri pond. A **pond**, an enclosed body of fresh water, is a busy place. A **pond ecosystem** is home to many organisms that live in or near the water. Some of the organisms that live in a pond ecosystem are fish, frogs, snakes, birds, dragonflies and plants such as cattails and duckweed.

A pond provides communities of plant and animal populations with exactly what they need to survive. Some pond organisms live in the water for all or part of their life. Other organisms may not live *in* the pond, but their survival depends on the plants and animals that do.

Water, sunlight, air, soil and temperature are non-living things. The interaction of non-living things with plant and animal life found in every layer of a pond is important to the health of the pond ecosystem. Water-loving plants provide shelter for organisms. Even thick, gooey mud at the bottom of a pond provides an environment rich in food and shelter for pond organisms. Tiny bits of rock in mud are non-living, but mud also contains rich nutrients for pond plants and provides places for the seeds of water plants to sprout and grow.

A pond is usually shallow enough for sunshine to reach the bottom. Sunlight warms the water and creates different layers of light. Organisms use these layers in different ways to find the food and shelter they need to survive.

Red-eared slider

Frogs and toads both lay their eggs in the water. Frogs tend to lay eggs in globby clusters. Toads tend to lay eggs in long chains that look like strands of black pearls.

One of the smallest flowering plants, duckweed floats on pond surfaces with tiny roots hanging down into the water.

key

1—Raccoon
2—Muskrat
3—Human
4—Great blue heron
5—Mallard duck
6—Green frog
7—Red-eared slider
8—Common snapping turtle
9—Northern water snake
10—Northern crayfish
11—Fishing spider
12—Water strider
13—Green darner dragonfly
14—Mosquito
15—Yellow drake mayfly
16—Blue-fronted dancer damselfly nymph
17—Blue-fronted dancer damselfly
18—Giant floater mussel
19—Predacious diving beetle
20—Freshwater jellyfish
21—Water flea
22—Pond snail
23—Largemouth bass
24—Bluegill
25—Fathead minnow
26—Channel catfish
27—Common carp
28—Algae
29—Coontail
30—Duckweed
31—Water primrose
32—Yellow water lily
33—Common sedge
34—Cattail
35—Black willow
36—Box elder
37—Pin oak
38—Sycamore

It may not smell nice or look pretty, but the mucky mud at the bottom of a pond is full of nutrients that keep many pond organisms alive and healthy.

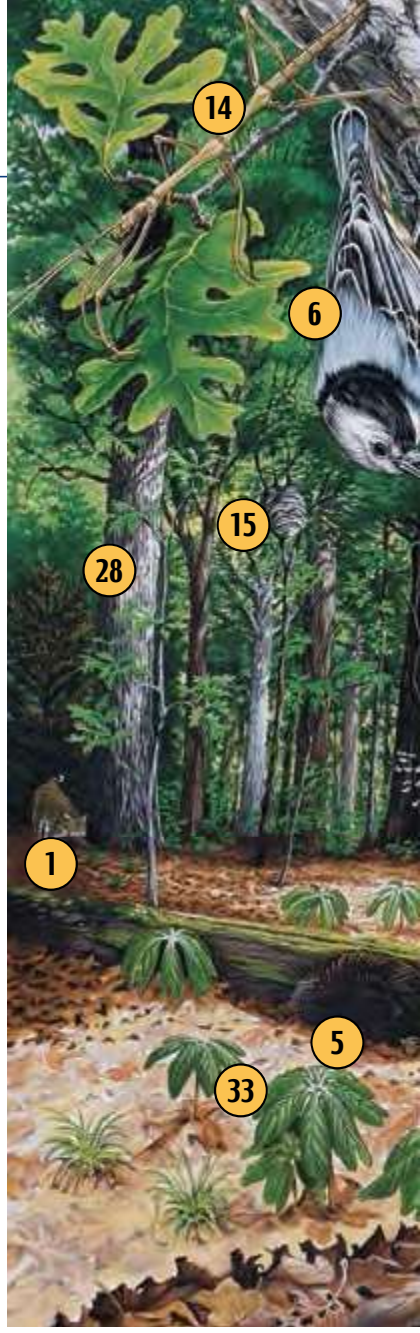
forest ecosystem

Forests are large areas of land covered mostly with trees, but forests are more than trees. They are communities of plants and animals that live in, around and under the trees. Soil, water, air and sunlight are some of the non-living things found in a forest ecosystem. Living things interact with the non-living things to create a **forest ecosystem**.

Forests also may appear to be quiet, but they are full of activity. A forest ecosystem extends deep below the forest floor where the roots of plants and trees compete with other organisms for nutrients, water and space in the soil. Low-growing plants and mosses, plus layers of decaying leaves, trees and branches blanket the forest floor and add nutrients to the soil. The understory is the middle layer of the forest and consists of smaller, shade-loving trees, shrubs and vines. Branches and leaves, or the crowns, of the tallest trees make up the top layer of the forest called the canopy. The canopy provides shade to understory and forest floor plants. Trees in the canopy use energy from all the sunlight to make leaves, nuts and fruits. Energy from the leaves, nuts and fruits is passed along to forest organisms. Populations of plants and animals compete for the food, water, shelter and space found at each of these forest layers.

Savannas in Missouri are also areas of land with trees, but savannas differ from true forests. Trees in a savanna do not grow close together but are spread apart, allowing more sunlight to reach the ground.

More grasses and wildflowers are able to grow in savannas than in forests.

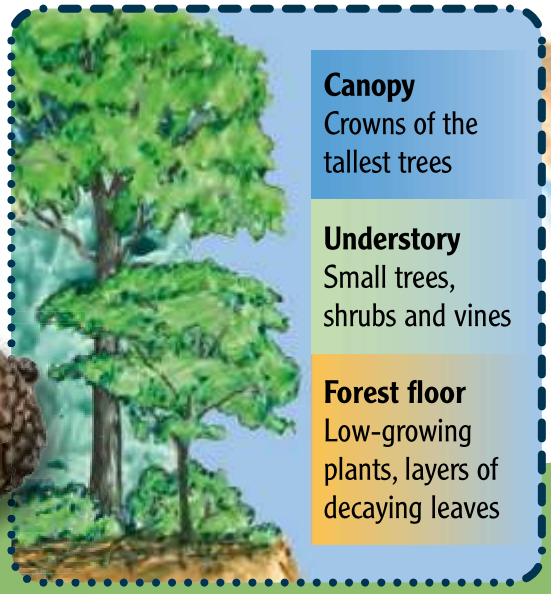


Spotted salamander

White oak leaf

White oak acorn

Spotted salamanders are secretive amphibians that live hidden under rocks or logs or in the burrows of other forest animals. In early spring, spotted salamander return to shallow, fishless, woodland ponds to mate and lay eggs.



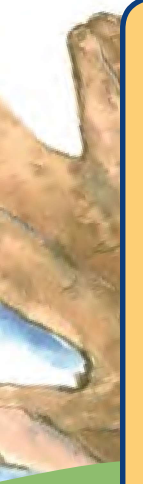
Canopy
Crowns of the tallest trees

Understory
Small trees, shrubs and vines

Forest floor
Low-growing plants, layers of decaying leaves

key

1—Bobcat
2—Fox squirrel
3—White-tailed deer
4—Woodland vole
5—Wild turkey
6—White-breasted nuthatch
7—Great horned owl
8—Pileated woodpecker
9—Ovenbird
10—Gray treefrog
11—Rough green snake
12—Tiger salamander
13—Three-toed box turtle
14—Walking stick
15—Bald-faced hornet nest
16—Io moth
17—Spicebush swallowtail caterpillar
18—Termites
19—Carpenter ant
20—Sowbug
21—Centipede
22—Earthworm
23—Cicada nymph
24—Junebug grub
25—White oak & acorn
26—Flowering dogwood
27—Oak and hickory forest
28—Redcedar
29—Red maple seed
30—Hickory seedling
31—Sassafras seedling
32—Virginia creeper vine
33—Mayapple
34—Dutchman's breeches
35—Blue violet
36—Mosses
37—Shelf mushroom



Tall grasses fill out the spaces among the scattered trees of a savanna.

prairie ecosystem

Prairies are huge grasslands with over 300 different kinds of grasses and wildflowers. These wildflowers are called forbs. You might also see a few woody shrubs on a prairie, but you would not see many trees.

Prairie communities could not exist without the grasses. Prairie grasses grow in thick clumps that animals use as shelter and nesting spots. Deep roots of prairie grasses hug and hold the soil, keeping the soil moist and holding it in place.

Prairie ecosystems provide everything prairie plants and animals need to survive. Plenty of sunlight, deep soil, water, shelter and food give organisms a place to grow or to raise young. Insects make up the largest number of prairie animals. Ants, bees, butterflies, moths, beetles and thousands of other types of insects are found in prairies. Insect populations are important to the health of prairie ecosystems as pollinators and as a source of food for birds and other animals.

Buzzing, clicking and whirring sounds of insects join the beautiful calls and songs of prairie birds. Birds are the most visible prairie animals. Prairie birds include northern harriers, upland sandpipers, bobolinks, bobwhite quail, prairie-chickens and several kinds of sparrow. Calls of amphibians such as the crawfish frog join the prairie chorus.

Secretive reptiles such as ornate box turtles and bullsnakes move silently among prairie plants, while prairie voles, plains pocket gophers and other small mammals spend most of their time hidden under the grasses or in burrows. Rabbits, coyotes and white-tailed deer also use prairies for part of their habitat needs.

Along with sunlight, water, soil, air and temperature, fire is a vital non-living part of a healthy prairie. Fire burns off trees that block sunlight from prairie plants and destroys other plants that would take over and change a prairie ecosystem.

key

1—Badger
2—Coyote
3—Spotted skunk
4—Prairie vole
5—Plains pocket gopher
6—Thirteen-lined ground squirrel
7—Greater prairie-chicken
8—Northern harrier
9—Upland sandpiper
10—Bobwhite quail
11—Bobolink
12—Grasshopper sparrow
13—Northern crawfish frog
14—Bullsnake
15—Speckled kingsnake
16—Ornate box turtle
17—Great plains skink
18—Grassland crayfish
19—Regal fritillary
20—Leaf beetle
21—Honeybee
22—Round-winged katydid (pink form)
23—Prairie mound ant
24—Prairie mole cricket
25—Yellow garden spider
26—Big bluestem
27—Little bluestem
28—Indian grass
29—Prairie blazing star
30—Purple coneflower
31—Switch grass
32—Compass plant
33—Sideoats grama grass
34—Prairie fringed orchid
35—Royal catchfly
36—Prairie rose
37—Blackberries
38—Gaura

Regal fritillary

Regal fritillary caterpillars munch only on violets. As adult butterflies, regal fritillaries visit many prairie flowers for nectar.

Fire helps prairie grasses and forbs. When burned by fires, these plants grow back quickly and stronger.

summary Ponds, forests and prairies are all ecosystems found in Missouri. Each one is different, but each one has both living and non-living things and each one supports the survival of different types of plants and animals. Populations of plants and animals live in ecosystems that supply them with the food, water, shelter, air and space they need to survive.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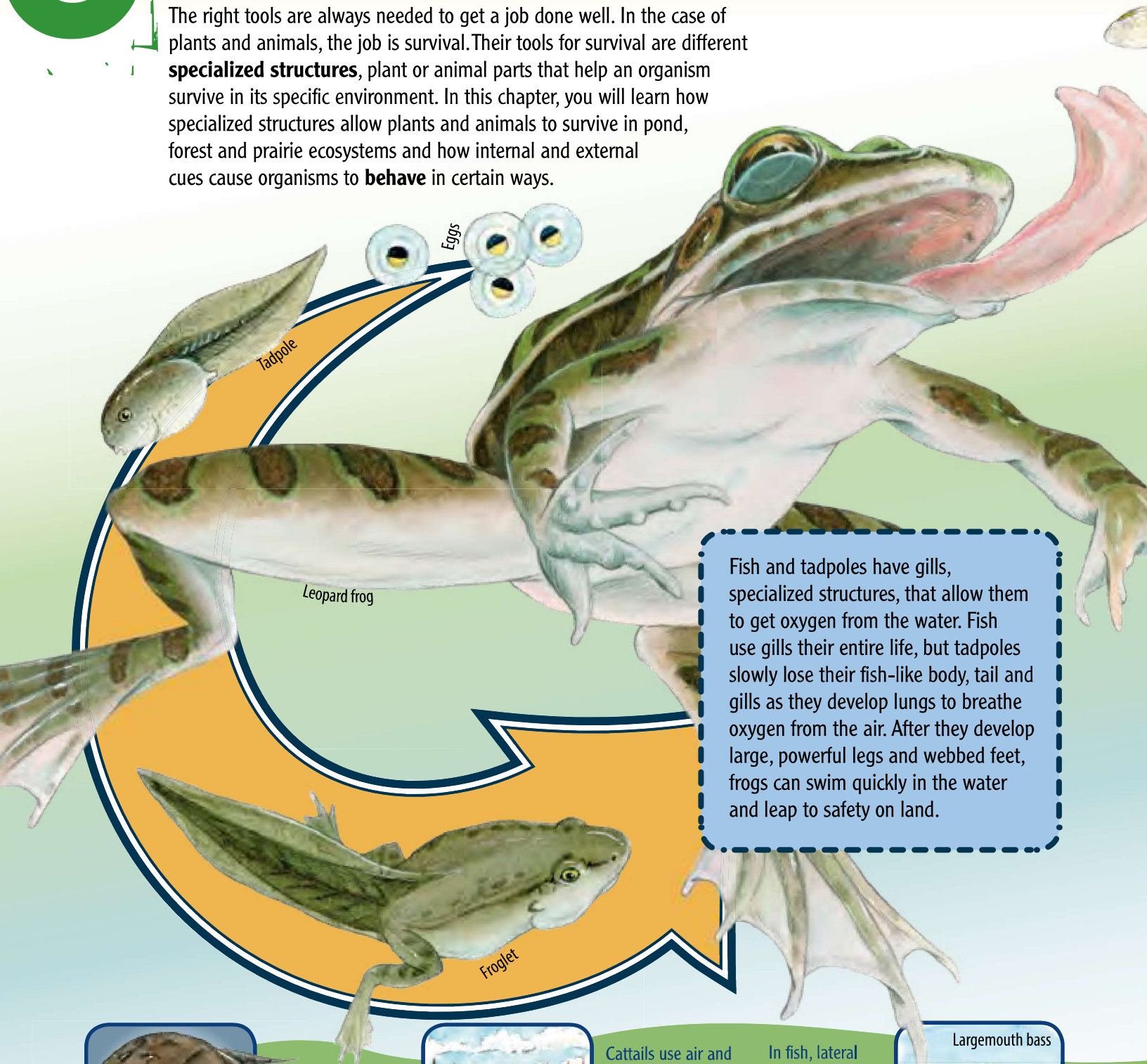
DAVID BESCHNER

3 having what it takes—to survive!

The right tools are always needed to get a job done well. In the case of plants and animals, the job is survival. Their tools for survival are different **specialized structures**, plant or animal parts that help an organism survive in its specific environment. In this chapter, you will learn how specialized structures allow plants and animals to survive in pond, forest and prairie ecosystems and how internal and external cues cause organisms to **behave** in certain ways.

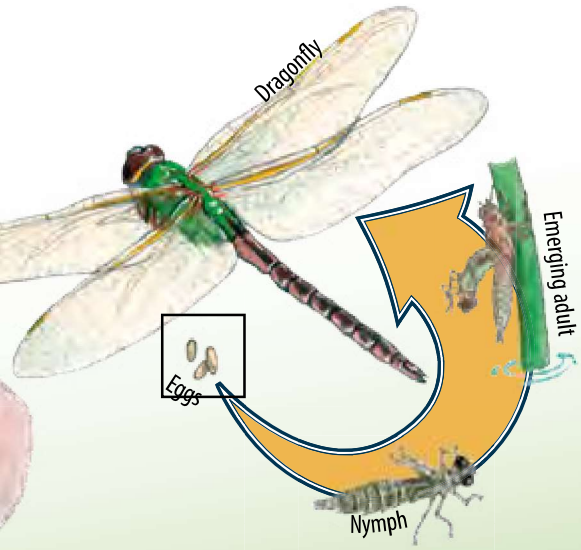


Fish and tadpoles have gills, specialized structures, that allow them to get oxygen from the water. Fish use gills their entire life, but tadpoles slowly lose their fish-like body, tail and gills as they develop lungs to breathe oxygen from the air. After they develop large, powerful legs and webbed feet, frogs can swim quickly in the water and leap to safety on land.

A common snapping turtle has great big jaws, that help it snap up organisms as large as fish and snakes.

Cattails use air and mud to reproduce. When their fluffy seeds are blown away and land in mud, new plants can grow.

In fish, lateral lines along their sides are sense organs that detect movement and vibration in the water.



Dragonflies begin their lives in the water as nymphs with gill-like structures on their abdomen. When a dragonfly nymph is ready to change into an airborne adult, it climbs out of the water on the stem of a water plant, sheds its outer skin and uses its new special mouth parts and wings to eat while hovering and flying.

survival tools in a pond ecosystem

Plants and animals that spend all or part of their life in water must have specialized structures to survive in a watery environment.

Long toes allow great blue herons to move easily through ponds without sinking into the soft mud. Their long, slender necks and long, sharp beaks help them snatch fish and frogs from under water.

Pond plants have special structures that help them survive in their underwater surroundings or environment. Waxy or slimy coatings protect them from drying out when water levels drop. Special openings on stems or leaves let them absorb minerals directly from the water. Roots hold arrowhead and cattails in place while the above-water leaves of these plants bring air down to the roots. Tiny duckweed plants with thread-like roots survive by floating on the surface of the water.

Great blue heron

Bluegill

Frogs use their large, bulging eyes to eat! Frogs usually take in their food whole and use their eyeballs to squash down and swallow their meal.

Camouflage is one of the best survival tools an animal can have. Whether an animal is hunting or hiding, survival often depends on blending in and not being seen. Bluegill have light, vertical stripes that help them blend in when they hide among pond plants. Dark coloration on the top of channel catfish camouflages them and helps them blend into the mud at the bottom of the pond.

survival tools in a forest ecosystem

Trees have specialized structures to help them survive on land. Roots spread out almost twice as far as a tree is tall. Roots grow as they search for air, water and minerals in the soil. Tap roots grow deep down through the soil seeking water. Trunks support the branches and carry water and nutrients to and from the leaves. Bark wraps around and protects trees from injury and insects. Branches and leaves make up the tree's crown. Leaves use energy from the sun to produce food for the tree.

Seeds from trees and other forest plants also have specialized structures. Wing-like parts, fluffy coverings, and sticky surfaces are specialized seed structures. These specialized structures help seeds travel to places where they can find a place to grow.

Wing-like structures allow seeds to whirl and spin through the air. The spinning movement helps to plant the seed into the ground.

Seeds with soft fluffy coverings float through the air.

Seeds with prickly, sticky surfaces can hitch rides on the fur of animals and even on a person's clothing.

Forest animals have their own set of survival tools. Their specialized structures help them to see, hear and smell the plants and animals around them, to move silently, and to blend into their surroundings. Bobcats, for example, use their soft foot pads, dappled-colored fur and keen vision and smell to sneak up on rabbits. Rabbits, mice, voles and squirrels also have keen hearing, which they use to detect and escape from bobcats, owls and other animals that hunt them.

Special, sharp teeth help squirrels and deer crunch through tough acorns. Birds crack tough seed shells with sharp, specially shaped beaks. A 4-chambered stomach allows deer to digest grasses.

Glands are another type of specialized structure. Some snakes have glands that produce venom used for protection and to make their food hold still. Io moth caterpillars are bright green and have a red and white stripe along the sides of their bodies and many spines that are painful to touch. Whiskers on mammals and antennae on insects are also examples of specialized structures used by organisms to gather information about their environment.

Great horned owl

An owl's huge eyes gather enough light to give them excellent night vision. What may look like ears on some owls are actually tufts of feathers. Ear openings are hidden under feathers and located to the sides of and just behind the eyes.

Sharp talons allow owls to grasp unsuspecting mice.

Softly ruffled and dark-colored feathers allow owls to swoop down silently on their prey in the dark of night.

Animals are torn apart with an owl's talons and sharp beak or swallowed whole. Bones, feathers and fur that are too hard to digest are coughed up hours later in a firm, rounded pellet. Owl pellets reveal clues and solve mysteries about what an owl has captured and eaten.

Flying squirrels are gliders rather than fliers. To move from tree to tree, a flying squirrel leaps and stretches its loose folds of skin out to the sides. This skin acts like a flat parachute.

Specialized eyes, ears, feet, teeth, beaks and whiskers are survival tools for prairie animals. Badgers use large claws for digging burrows and defending themselves. Coyotes depend on their keen sense of smell, hearing and sight to catch mice running through the tall grass. Prairie voles and plains pocket gophers have strong front paws for tunneling underground to safety and to find roots and leaves to eat.

Badgers are built for digging. Their heavy body, powerful muscles, strong front feet and long claws make them one of the fastest diggers on the prairie! A badger might even use its mouth to help it dig. Badgers loosen the soil with their front feet, pass it under their belly and kick it out of the hole with their hind feet—loose soil is sometimes thrown four to five feet into the air! Badgers dig at a faster rate than a man can dig with a shovel! Being a fast digger means being able to catch fast-digging animals for food and being able to dig fast enough to escape enemies.

Badgers do not actually hibernate, but they do spend a lot of time sleeping in their burrows in the winter. When they wake up, they dig around for animals that are hibernating, dig those animals up, eat those animals, and then go back to sleep in their own burrows.

There is rarely a pile of earth around the tunnel openings of a thirteen-lined ground squirrel because they carry the soil in their cheek pouches and scatter it away from the burrow.

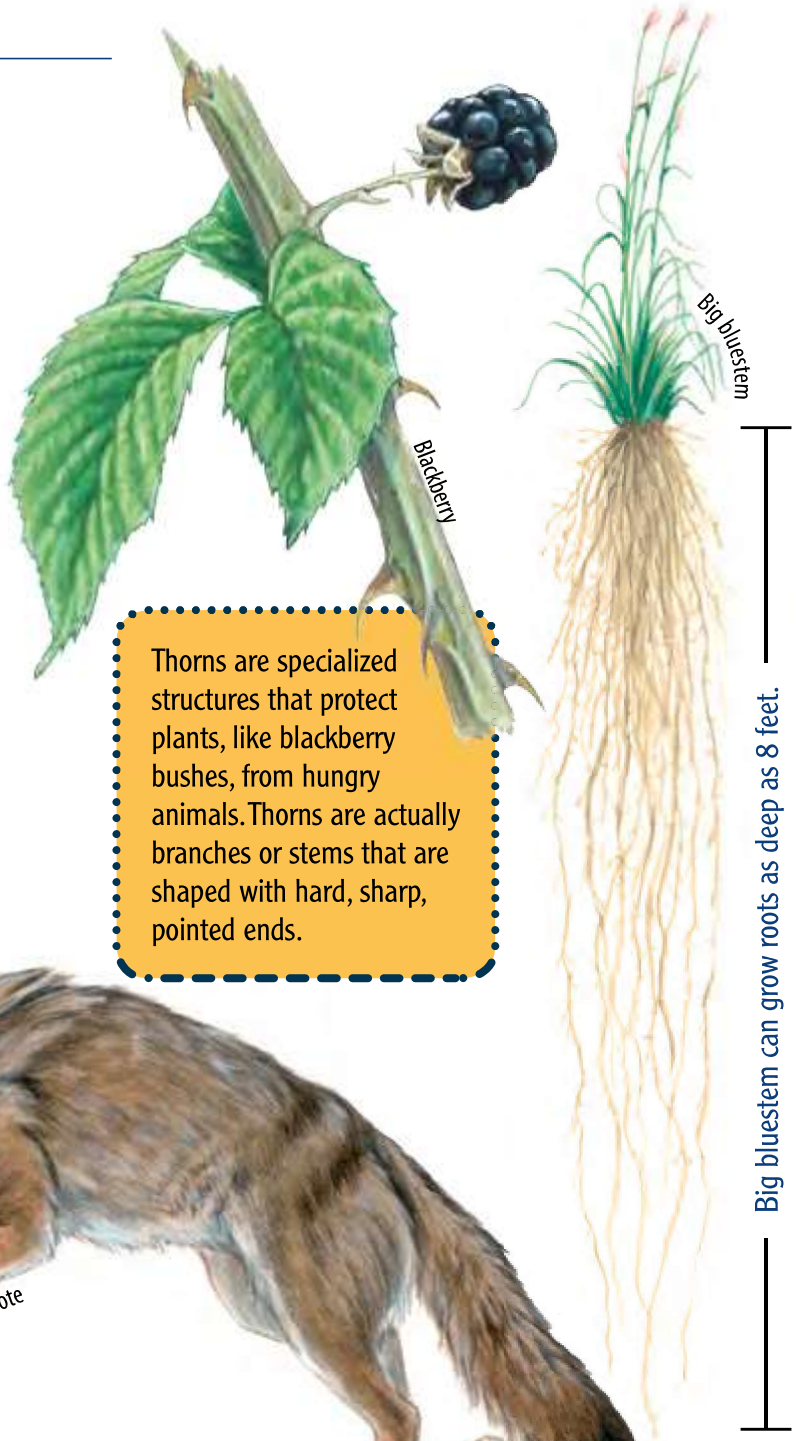
As ants dig tunnels for their nests, they move and mix the soil. This loosens the soil and allows prairie plants to grow.

Why dig when you can borrow a burrow? Northern crawfish frogs are very secretive and spend most of their time hidden in crawfish burrows or burrows of other animals.

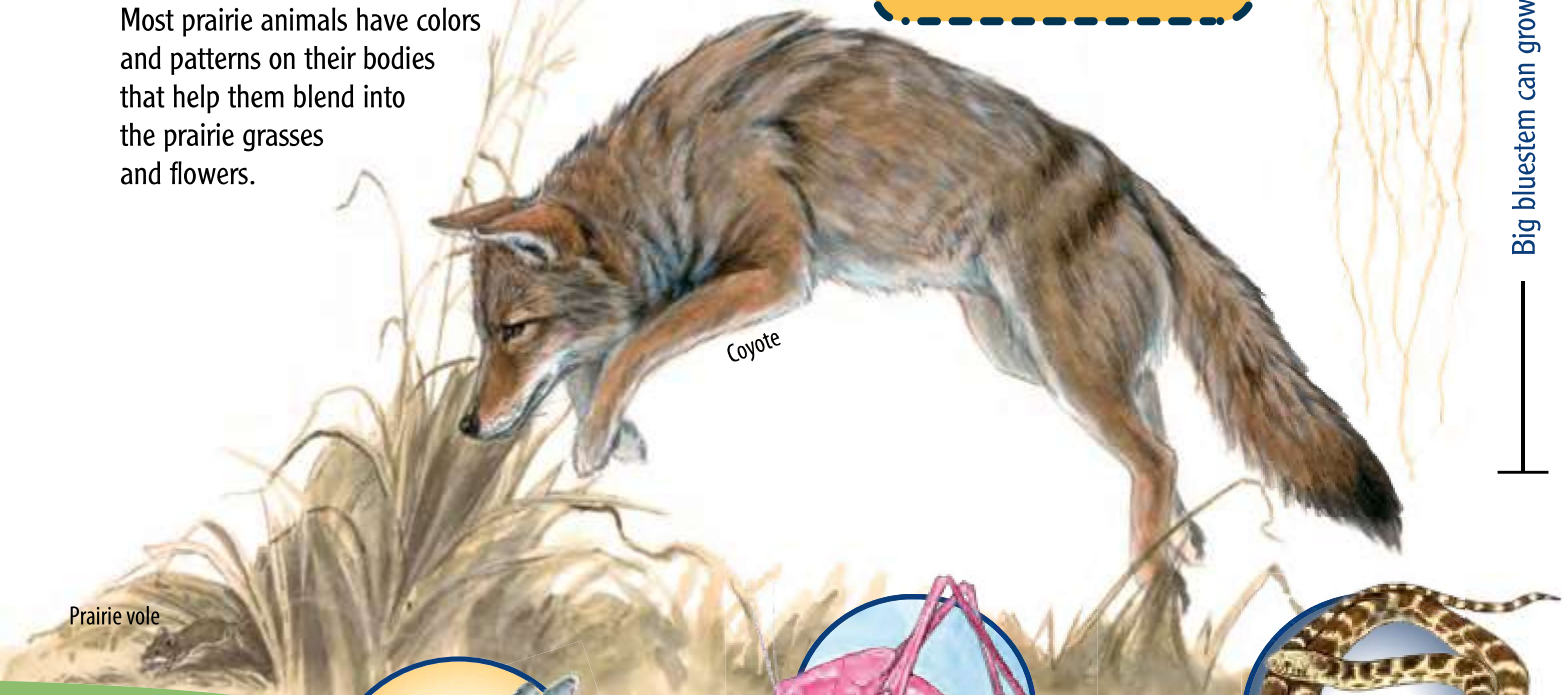
Prairie plants have specialized structures that help them survive in their environment. Special root systems allow them to grow deep down into the soil to reach water and nutrients and to anchor plants against strong winds and to protect them during dry weather. Big bluestem and little bluestem are common prairie grasses that grow in bunches with roots as deep as 8 feet. Prairie blazing star and compass plants have roots that can reach down as far as 15 feet. Stems of prairie roses and blackberries have sharp thorns to discourage animals from eating them.

Other prairie plants have specialized structures that invite organisms to feed from them. Bright red royal catchfly flowers have long, tube-like shapes. The special color and shape of these flowers attract hummingbirds. While hummingbirds use their special, long tongues and beaks to sip nectar deep within the flowers, they also gather and pass pollen from one royal catchfly to another.

In vast open prairies, camouflage is a very important survival tool. Most prairie animals have colors and patterns on their bodies that help them blend into the prairie grasses and flowers.



Thorns are specialized structures that protect plants, like blackberry bushes, from hungry animals. Thorns are actually branches or stems that are shaped with hard, sharp, pointed ends.



Hummingbirds are the only birds that can fly backwards, and they can hover in mid-air by rapidly beating their wings 53 times per second!

Being bright pink might not seem like a good camouflage color unless you live among the brightly colored flowers of a prairie.

A bullsnake's color and markings keep it camouflaged so it can sneak up on its food *and* stay hidden from animals that want to eat it.

oh, behave!

Survival of organisms in all three of these ecosystems also depends on how the organisms behave when they get cues or signs, either from their own bodies or from the world around them. Organisms respond to internal cues and external cues by changing their **behavior** in a way that will allow them to survive.

Internal cues are the ones an organism receives from inside itself. Hunger is an internal cue, and it will cause an animal to stop whatever it is doing and start hunting or foraging for food. Internal cues cause thirsty animals to search new places for water. High heat and dryness caused by lack of rain are **external cues**. Trees and other plants respond to these external cues by sending roots deeper into the ground to seek water. Deep, specialized roots of prairie grasses hug the soil and hold water like a sponge. This helps the grasses and forbs survive even when there is little or no rain.

Movement and sound are external cues that cause animals to take notice. For most animals, sudden movement or sound signals possible danger and prompts them to run, fly, swim or stay perfectly still.

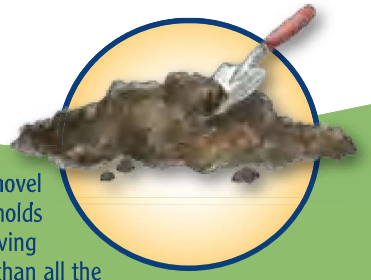
Weather, temperature and amounts of daylight and darkness are some external cues that cause organisms to change behavior. Missouri's pond, forest and prairie organisms automatically change behavior in the fall when days are shorter and cooler. Snakes, lizards and certain frogs seek out dens or abandoned burrows to **hibernate** or sleep for the winter. Some frogs and snails burrow into the mud at the bottom of the pond to survive the cold winter.

Tree squirrels, mice and beavers stay active through the winter. However, cooler temperatures and shorter days are external cues that drive them to eat more food to insulate their bodies with extra layers of fat. Fall's external cues also prompt them to gather and store larger amounts of food to last through the winter.

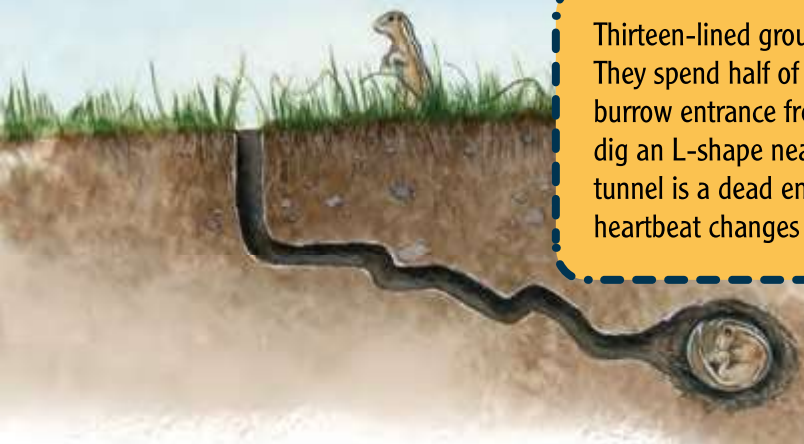
Some birds find enough seeds and dried berries to survive Missouri winters. Others such as ducks, geese and hummingbirds react to those external temperature and daylight cues by migrating hundreds of miles south to spend winter in warmer climates. Ducks and geese migrate in various V-shaped patterns and often noisy flocks. Hummingbirds migrate alone.

Northern water snakes warm up on branches overhanging water or on logs or rocks along the water's edge. They cool off during hot summer weather by coming out mostly at night.

Earthworms move deeper into the soil to avoid extreme dry conditions and extreme cold soil conditions.



Each shovel of soil holds more living things than all the human beings ever born!



Thirteen-lined ground squirrels stand on their hind legs to watch for danger. They spend half of their time in their underground burrow. They keep their burrow entrance free of loose dirt by "sweeping" it with their back feet. They dig an L-shape near the entrance which works to fool animals into thinking the tunnel is a dead end. During hibernation, the thirteen-lined ground squirrel's heartbeat changes from 350 beats per minute to only five beats per minute.

Can you tap your feet 350 times in one minute?

Spiders and insects whose life cycles end with winter spend the cool fall months finding mates and eating extra amounts of food for energy to lay eggs that will hatch out in the spring. Other pond, forest and prairie insects sense these external cues and prepare for winter by hiding underground, in soft, muddy pond bottoms, in small openings in tree bark, or in tunnels burrowed deep within rotting logs or tree branches.

Plants in ponds, forests and prairies also react to fall's external cues. Certain plants prepare for winter by cutting off nutrients to leaves and stems. The leaves become dry and fall, and the plants reserve energy by going dormant, slowing down growth.

As winter melts away and days become longer and warmer, external cues of spring trigger the return of migratory birds and the awakening of hibernating and dormant organisms. Frogs and salamanders seek mates and lay eggs in the cold, late winter ponds. Snakes and turtles emerge. Insects hatch. Mice, who scurried under blankets of snow, must now move cautiously on the ground. Hawks and foxes, who struggled during the winter to find snow-hidden mice, now become more successful and are able to feed their young.

Small understory trees and plants such as dogwoods and mayapples sense external temperature and daylight cues. They bloom early in the spring before the leaves of taller trees unfurl in the canopy and block the sun from the forest floor.

Summary

Specialized structures and camouflage help organisms stay safe and survive in their ecosystems. Survival means these plants and animals will be able to grow, reproduce and increase their populations.

Organisms also react to internal and external cues. These cues cause animals to behave in ways that will also help them survive.

What animal has most of its body frozen during winter hibernation, sings a loud "peeper" call in early spring, and is about the size of your big toe?

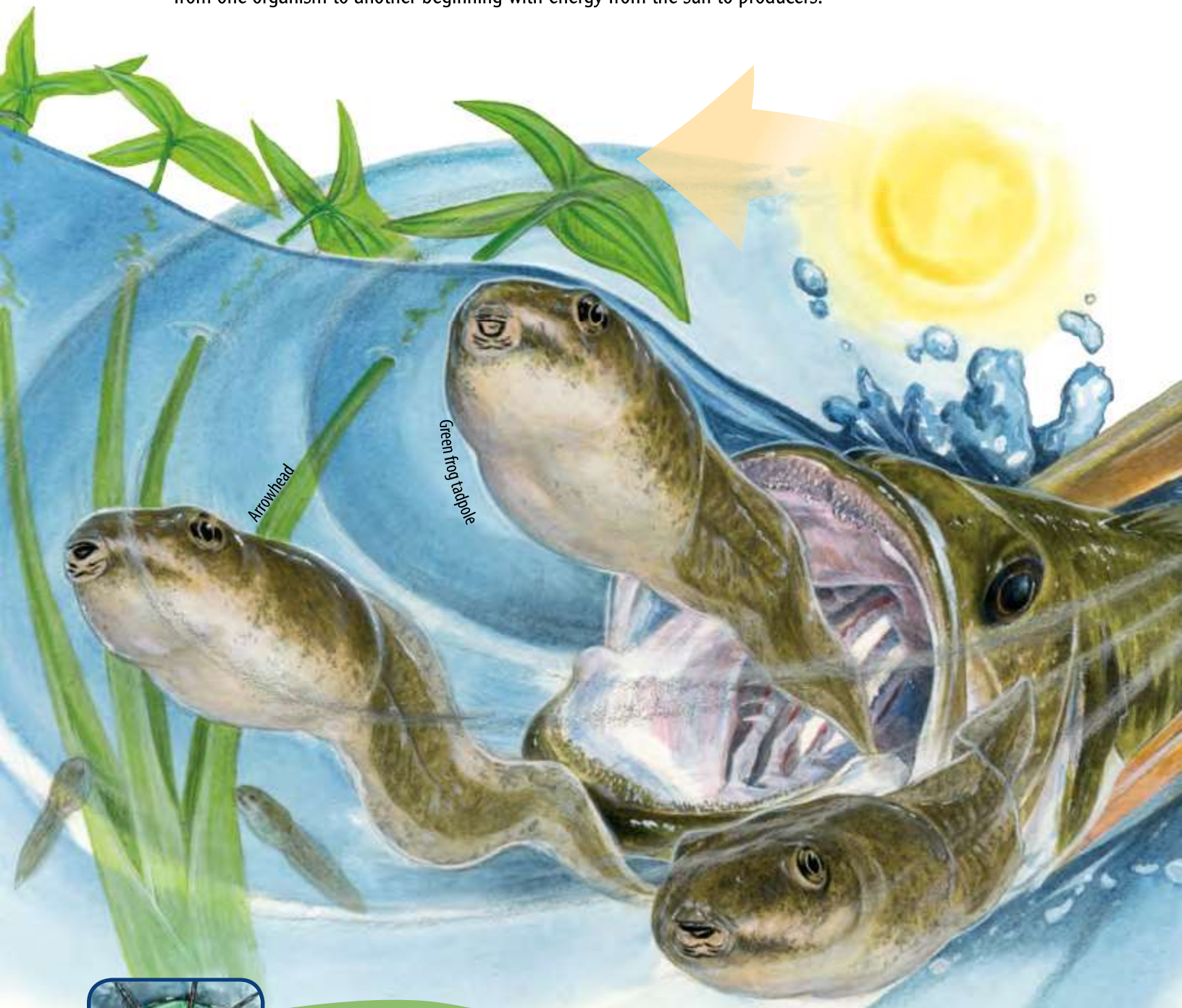
A spring peeper

Plains pocket gophers run backwards in their burrows as fast as they run forward. Their loose skin lets them turn a somersault in the tunnel for a quick getaway.

A mayapple's umbrella-like leaves grow each spring for seven years before it has a flower.

4 chain of foods

There would be no life on Earth without the sun. In this chapter, you will learn how the sun is the energy source that helps plants produce energy. **Food chains** transfer energy from one organism to another beginning with energy from the sun to producers.



Fishing spiders swim or walk on water to catch their food. They can wait almost completely under water for brief periods of time to capture insects, small fish and tadpoles.

Even though great blue herons are large birds with long, sharp beaks, they can choke to death trying to eat a fish that is too large to swallow.

Pond plants, such as cattails and arrowhead, are producers that use energy from sunlight filtering down through the water to make their own food. Tadpoles eat a special kind of pond plant called algae to get energy. Algae can be found on plants and can also float freely in the water. Fish get energy by eating tadpoles, and great blue herons get energy by eating fish. Tadpoles, fish and great blue herons are consumers. These plants and animals are linked together in one of many pond food chains that begin with the sun.

Great blue heron

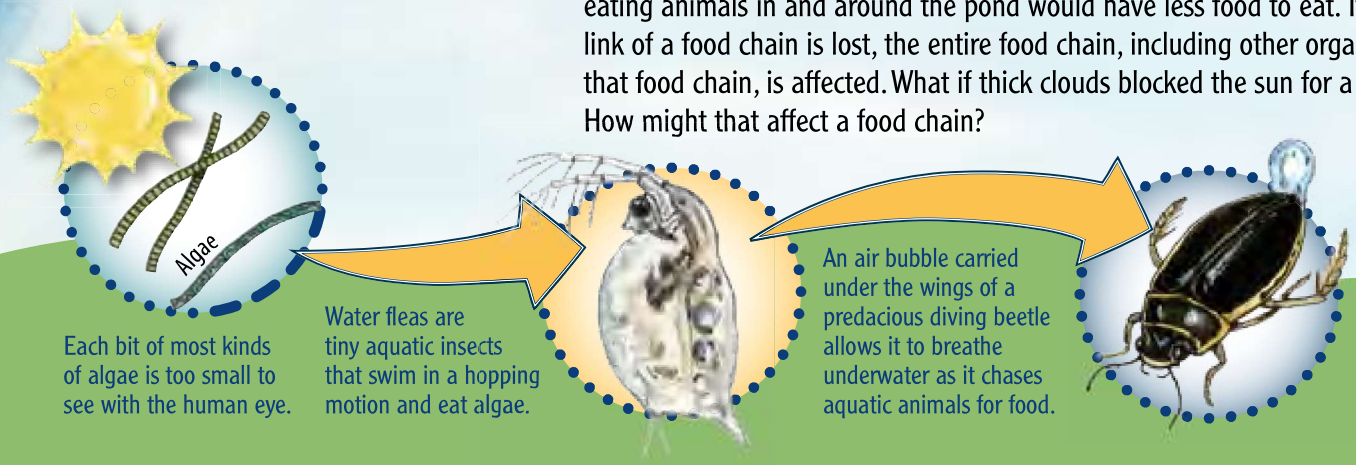
Largemouth bass

Each plant acts as its own food factory using energy from the sun to create or "cook up" its "energy recipe." Carbon dioxide from the air and minerals from the soil and water are used by plants in this "recipe," but sunlight is the key ingredient. Because they make their own food, plants are called **producers**.

Animals are not producers because they cannot make their own food. Animals must get their food and energy by eating plants and other animals. Because they eat other organisms, animals are called **consumers**. Consumers are organisms that eat other organisms to get the energy they need to survive.

A chain holds together only if its links are strong. A healthy ecosystem depends on many strong food chains. Strong food chains depend on having a certain number of each organism or link available in an ecosystem. When populations of organisms disappear from communities, food chains break down and entire ecosystems are weakened.

If all the frogs in a pond became sick and disappeared, fish and other frog-eating animals in and around the pond would have less food to eat. If just one link of a food chain is lost, the entire food chain, including other organisms in that food chain, is affected. What if thick clouds blocked the sun for a long time? How might that affect a food chain?



Each bit of most kinds of algae is too small to see with the human eye.

Water fleas are tiny aquatic insects that swim in a hopping motion and eat algae.

An air bubble carried under the wings of a predacious diving beetle allows it to breathe underwater as it chases aquatic animals for food.

forest food chain

In a forest food chain, a squirrel munches on a nut from a hickory tree until a great horned owl flies up and eats the squirrel. Energy is passed along from the sun to the nuts to the squirrel to the great horned owl. In this way, energy from the sun passes to a producer to a consumer and eventually to another consumer.

Squirrel

Pileated woodpeckers need dead trees—not just for shelter, but also for the colonies of carpenter ants living in them.

Io moths eat many different leaves and do all their eating as caterpillars. An Io moth adult has no mouth and cannot eat.

Squirrels use their keen sense of smell to locate buried nuts. Some birds, especially crows, will watch a squirrel bury a nut and will dig it up as soon as the squirrel leaves. Those they miss may sprout into young trees.

Great horned owl

In the late evening, and through the night, **nocturnal** animals locate the food they need for energy. Nocturnal animals have specialized structures that help them hunt for food or hide from danger in the dark. Dark coloration helps to camouflage them. A bobcat's large ears help it detect sounds, especially when it hunts at night, and its keen eyesight helps it find food when it hunts during daylight hours. Flying squirrels hardly ever move about in daylight but forage all night. Their keen sense of hearing and their large eyes keep them alert, and their dark colors help them disappear into the darkness at the slightest sign of danger.

Producers that used energy from the sun during the day, pass that energy along to the consumers that eat them and to the consumers that eat other consumers from early evening to early dawn.

Decaying leaves

Young sowbugs develop in a pouch on their mother's body. As adults, they will feed on dead or decaying plants and animals.

Ovenbirds feed and nest on the forest floor and use their bills to turn over leaves in search of snails, worms and sowbugs.

Peek carefully under a rock to find sowbugs. They'll roll up into a tight ball when they're disturbed.

prairie food chain

In a prairie, every time a consumer, such as a rabbit, eats a producer, such as grass seeds, the consumer (rabbit) takes in some of the energy that the producer (grass seeds) received from the sun. When a coyote, another consumer, creeps up quietly enough to grab and eat the rabbit, the coyote gains some of the energy that has been passed along from the sun to the grass seeds to the rabbit. The sun, the grass seeds, the rabbit and the coyote are linked together in a prairie food chain.

If prairie grasses disappeared, populations of mice and voles would decrease because there would be less of their main food source to eat. Populations of snakes that depend on mice and voles for food and energy would decrease, and hawks would have fewer mice, voles and snakes to eat or to feed their young.

Cottontail rabbit

Prairie voles create tunnels under the snow to keep them hidden as they move about searching for food.

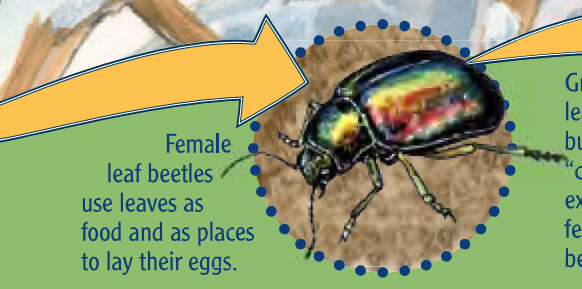
Grasshopper sparrows prepare grasshoppers to feed to nestlings by shaking off the grasshoppers legs—one pair at a time.

Decaying plants

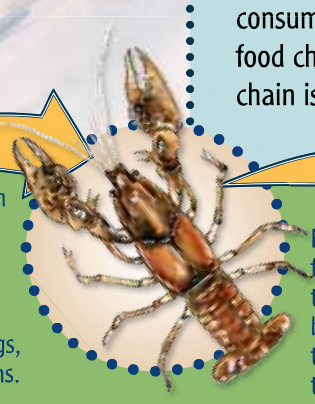
Coyote

Summary

Plants and animals need and use the energy of the sun in different ways. Plants are producers because they use sunlight directly for energy to make their own food. Animals are consumers because they get their food and energy by eating plants and other animals. Energy from the sun is passed up through all food chains—as the producers (plants) are eaten by the consumers (animals). When a population in a food chain is eliminated, the rest of the food chain is affected.



Female leaf beetles use leaves as food and as places to lay their eggs.



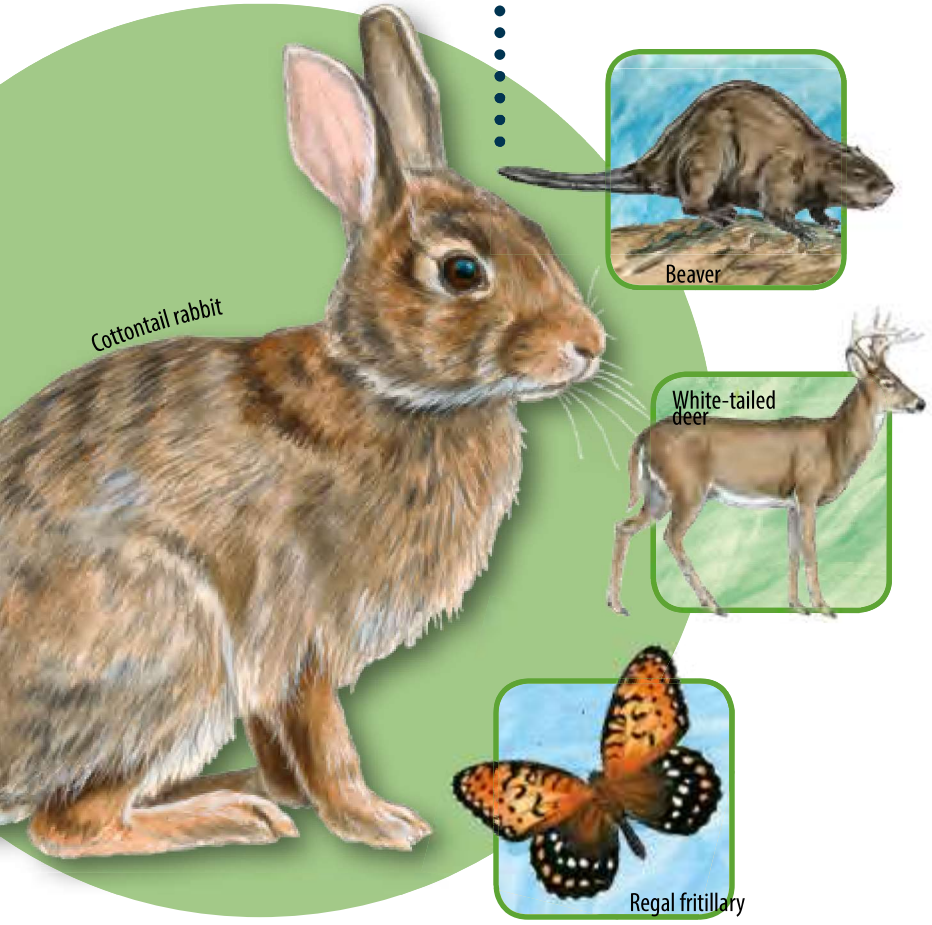
Grassland crayfish leave their deep burrows through "chimneys" of excavated soil to feed on small bugs, beetles and worms.

Northern crawfish frogs spend much time in crayfish burrows where they find most of their food—crayfish.

5 you eat what?!


Mallard

In food chains, energy from the sun is used by producers to make their own food. Producers are the first organisms eaten, and the first organisms to pass energy up through a food chain. Energy continues to be passed along a food chain when consumers eat producers and other consumers. This chapter shows the three types of consumers, what they eat and how to tell what they eat by their teeth. You also will learn about scavengers and decomposers, organisms that act as an ecosystem's clean-up crew.



herbivores

All animals are consumers, but not all consumers consume or eat the same foods. Animals that eat only plants are called **herbivores**.

Water fleas, snails, tadpoles and beavers are herbivores found in pond ecosystems. They get all the energy they need by eating algae and other plants that are growing in, around and under water.

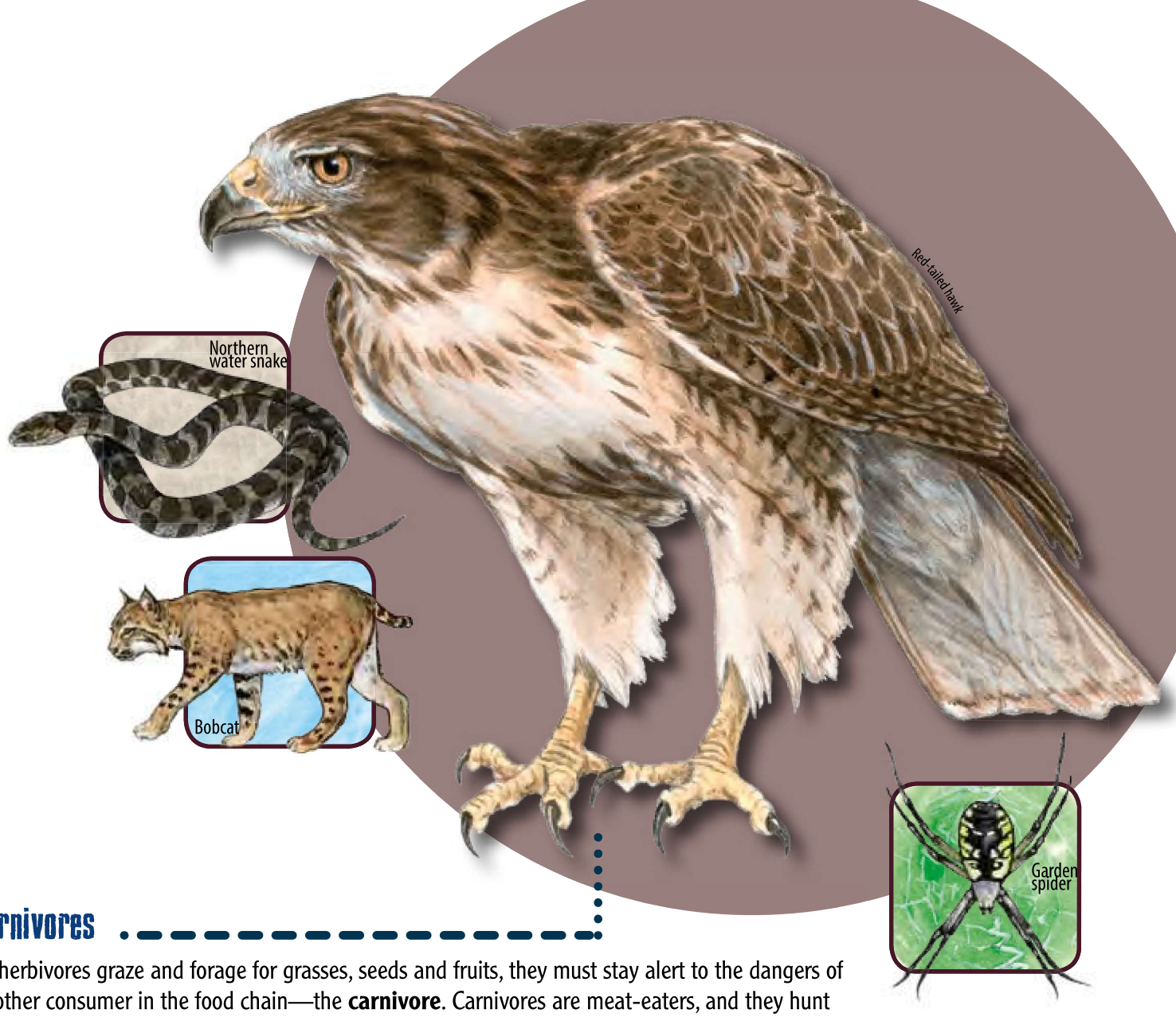
Spicebush swallowtail caterpillars are forest herbivores that feed on spicebush and sassafras leaves. As adult butterflies, they will seek out forest flowers for nectar. Fox squirrels and white-tailed deer are forest herbivores that forage for nuts, seeds and fruits. Tiny woodland voles live in tunnels under the forest soil and eat plants, berries and seeds they find underground.

Prairie grasses and forbs are food for many herbivores. Rabbits and gophers eat roots, stems, leaves, small fruits and seeds found throughout the prairie. Regal fritillary caterpillars eat violet leaves and sip nectar from wildflowers when they become adult butterflies. Adult leaf beetles eat plant leaves, and their larvae feed in the ground on juices from roots and stems.


Snails use a tongue-like structure covered with thousands of small teeth to scrape off and eat algae and other aquatic plants.


Certain types of cicadas spend 17 years underground, sucking sap from tree roots before emerging as adults.


Plains pocket gophers have cheek pouches used to carry nesting material and grasses, leaves, small fruits and seeds for food. Gophers turn these pouches inside out for cleaning.



carnivores

As herbivores graze and forage for grasses, seeds and fruits, they must stay alert to the dangers of another consumer in the food chain—the **carnivore**. Carnivores are meat-eaters, and they hunt other animals for food. Carnivores eat herbivores. Carnivores also eat other carnivores.

A carnivorous dragonfly nymph seizes and eats a tadpole, which is an herbivore. A fish swims up and swallows the dragonfly nymph. A northern water snake snaps up the fish, and energy is passed along the food chain.

In the forest, bobcats and great horned owls hunt mice, rabbits and other small mammals. Gray treefrogs cling to tree trunks in search of insects hidden in the bark. Centipedes explore soft tunnels in fallen logs for insects and other small animals. A rough green snake concentrates on swallowing a newly emerged cicada nymph but is caught off guard and swallowed by a hawk.

Prairies are abuzz with insects that are food for hawks, crawfish frogs, skinks, spiders and prairie mound ants. Badgers, hawks and snakes eat rodents, lizards, small birds and snakes.

Water striders walk and eat small insects on water! The surface tension of the pond and the water strider's brush-like leg structures make it possible.

Mole populations rise when there are lots of young cicadas to eat underground.

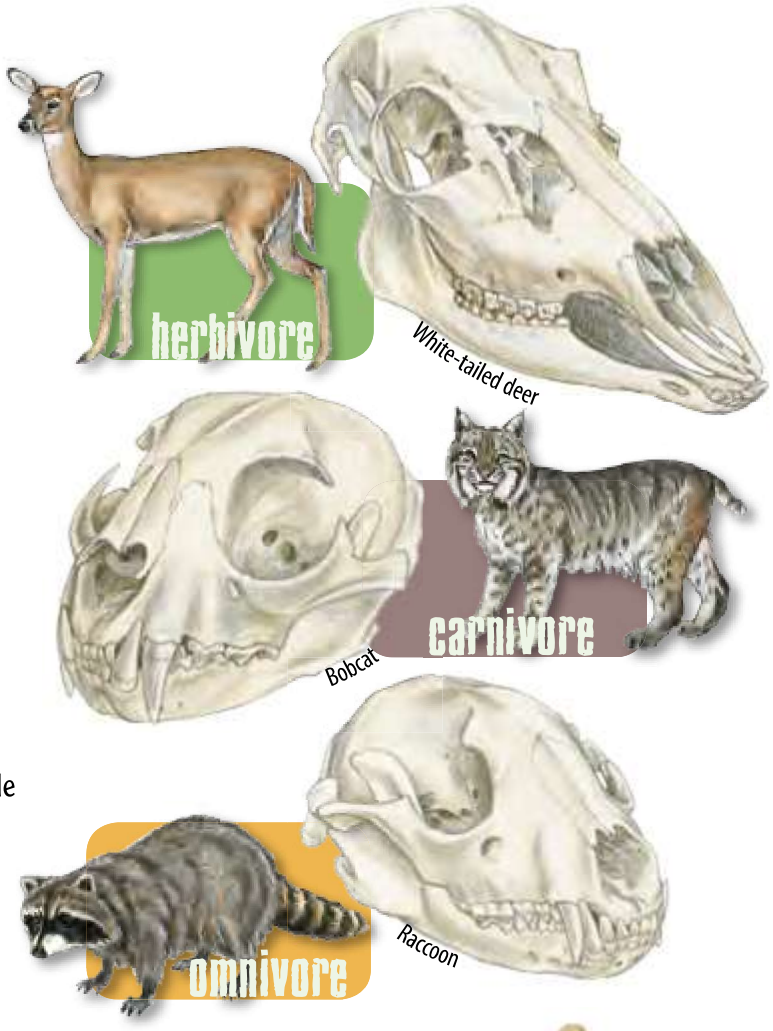
Snakes have small, sharp teeth pointed toward the back of their mouth. They are not used for chewing or tearing but for keeping prey from slipping out as it is slowly drawn in and eaten whole.

omnivores

Herbivores and carnivores face different challenges when it comes to finding food that fits their plant or meat diets. **Omnivores** are the third type of consumer, and finding food may be less of a challenge for them. Omnivores eat both plants and animals.

Muskrats eat roots and stems of pond plants but occasionally eat mussels, crayfish and frogs. Raccoons eat wild fruits and berries along with fish, frogs, birds and other small animals including muskrats. Channel catfish eat plant material but also eat small fish and insects.

Forests provide wild turkeys with acorns and insects and box turtles with berries, insects and worms. Skunks eat plants, insects and mice. Bobolinks, prairie-chicken adults, prairie mole crickets, grasshopper sparrows and other prairie omnivores eat different plant parts, but they also eat insects and small organisms.



my what big teeth you have!

Teeth are specialized structures.They give clues about what an animal eats. Herbivores have large, sharp front teeth that help them snip off grasses and leaves. Flat, grinding teeth sit back inside their cheeks and help them crush seeds and tough plant parts.

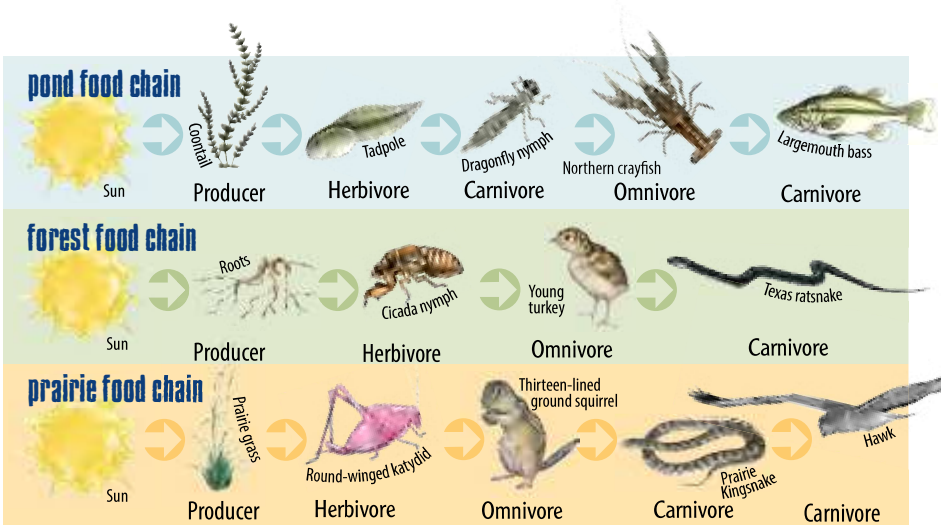
Carnivores need teeth that can tear and rip, as well as grind and chew. Flatter teeth that grind up meat and bones line the sides of their mouths. Carnivores also have long, sharp, pointed teeth on either side of short, sharp front teeth for gripping and tearing food.

Some omnivores have teeth that look like those of herbivores and carnivores. Other omnivores like robins and turkeys have no teeth at all. Instead they have beaks that help them capture insects and eat seeds and fruits.

Fungi are the most important decomposer in a forest ecosystem. By breaking down dead organisms, they provide nutrients that living organisms need to survive.

Centipedes are nocturnal carnivores found in forests under bark, rotting wood or decaying plants.

Morel mushrooms are fungi that grow in greater numbers than usual for 2–3 years following a forest fire.



Summary

Animals are classified by the type of food they eat. Plant eaters are herbivores, and meat eaters are carnivores. Animals that eat both plants and meat are omnivores.

Herbivores and carnivores can be identified by looking at their teeth.

Decomposers are organisms that eat dead plants and animals. They digest and break down dead organisms into tiny nutrients which are then returned to the soil. Scavengers also clean up dead and decaying organisms.

nature's clean-up crew

When plants and animals leave waste behind or die, bacteria, fungi and insects clean up. These special organisms are called **decomposers**. Decomposers eat and break down scat, or animal droppings, and dead plants and animals into tiny parts.

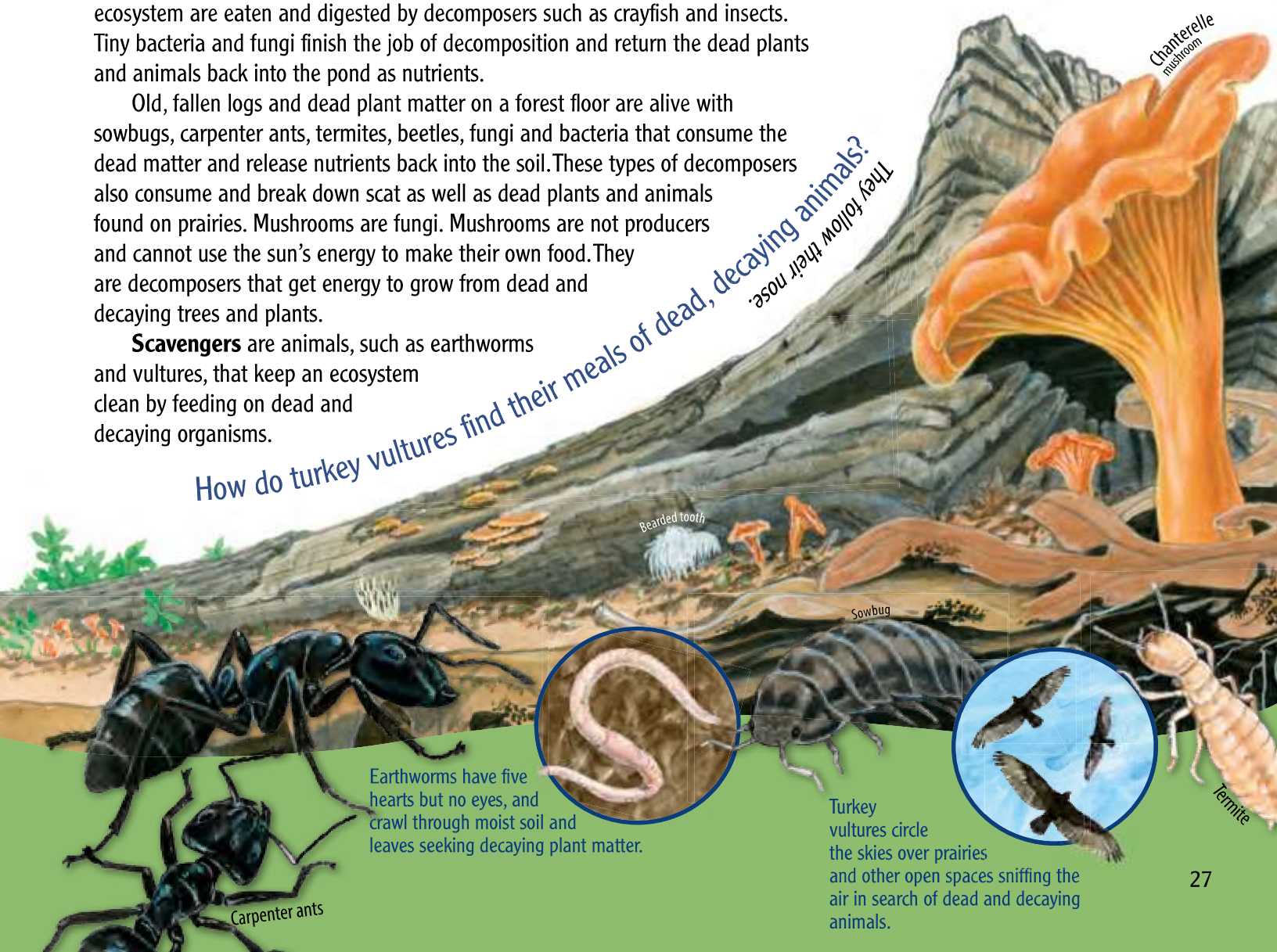
Animals and plants that die or are left half-eaten by other animals in a pond ecosystem are eaten and digested by decomposers such as crayfish and insects. Tiny bacteria and fungi finish the job of decomposition and return the dead plants and animals back into the pond as nutrients.

Old, fallen logs and dead plant matter on a forest floor are alive with sowbugs, carpenter ants, termites, beetles, fungi and bacteria that consume the dead matter and release nutrients back into the soil. These types of decomposers also consume and break down scat as well as dead plants and animals found on prairies. Mushrooms are fungi. Mushrooms are not producers and cannot use the sun's energy to make their own food. They are decomposers that get energy to grow from dead and decaying trees and plants.

Scavengers are animals, such as earthworms and vultures, that keep an ecosystem clean by feeding on dead and decaying organisms.

How do turkey vultures find their meals of dead, decaying animals?

They follow their nose.



Earthworms have five hearts but no eyes, and crawl through moist soil and leaves seeking decaying plant matter.

Turkey vultures circle the skies over prairies and other open spaces sniffing the air in search of dead and decaying animals.

6 you want flies with that?

Producers make their own food using energy from the sun. Consumers get their food by eating producers or other consumers. Herbivores eat plants. Carnivores eat animals. Omnivores eat both plants and animals. In this chapter, you will learn about how these three consumers are either the hunters or the hunted, or both.

A speckled kingsnake slithers through prairie grasses in search of food, such as an unsuspecting prairie vole. A hungry hawk swoops down, seizes the snake, and takes it to a safe place to devour it. The vole is prey to the predator snake, but the snake becomes prey to the predator hawk.

In the prairie, bobcats, coyotes and hawks are predators. Mice, small birds and insects could be predators and could be prey. Insects eat prairie plants. Birds eat the insects. Hawks eat the birds.

Speckled kingsnakes, like the rest of Missouri's kingsnakes, are immune to the venom of copperheads, cottonmouths and rattlesnakes and can eat them without being harmed.

Most activity in a pond, forest and prairie ecosystem revolves around food—making it, eating it or being it! Animals that hunt for other animals are called **predators**. Animals that are hunted by other animals are called **prey**. Many prey animals are herbivores. All carnivores and omnivores are predators, but some carnivores and omnivores become prey.

As the tiny tadpole on page 16 nibbled algae, it was hunted and eaten by the fish. The fish was the predator, and the tadpole was the prey. However, that fish had barely swallowed the tadpole when it was grabbed up and gulped down by the great blue heron. The great blue heron was the predator, and the fish became the prey.

Carpenter ants are predators that prey on and hunt other insects, but carpenter ants become the prey animal when they are caught and eaten by spiders and other forest predators. Spiders are predators, but become prey when rough green snakes hunt and eat them. Rough green snakes may be predators, but even they become prey when they are eaten by larger snakes.

Speckled kingsnake

Prairie vole

Grassland crayfish

Crawfish frog

Leaf beetle

Bobcat

Ovenbird

Sowbug

When digging underground, a prairie vole closes its lips tightly to keep dirt out of its mouth. Prairie voles will signal a threat by raising their forefeet, stretching their head forward and chattering their teeth.

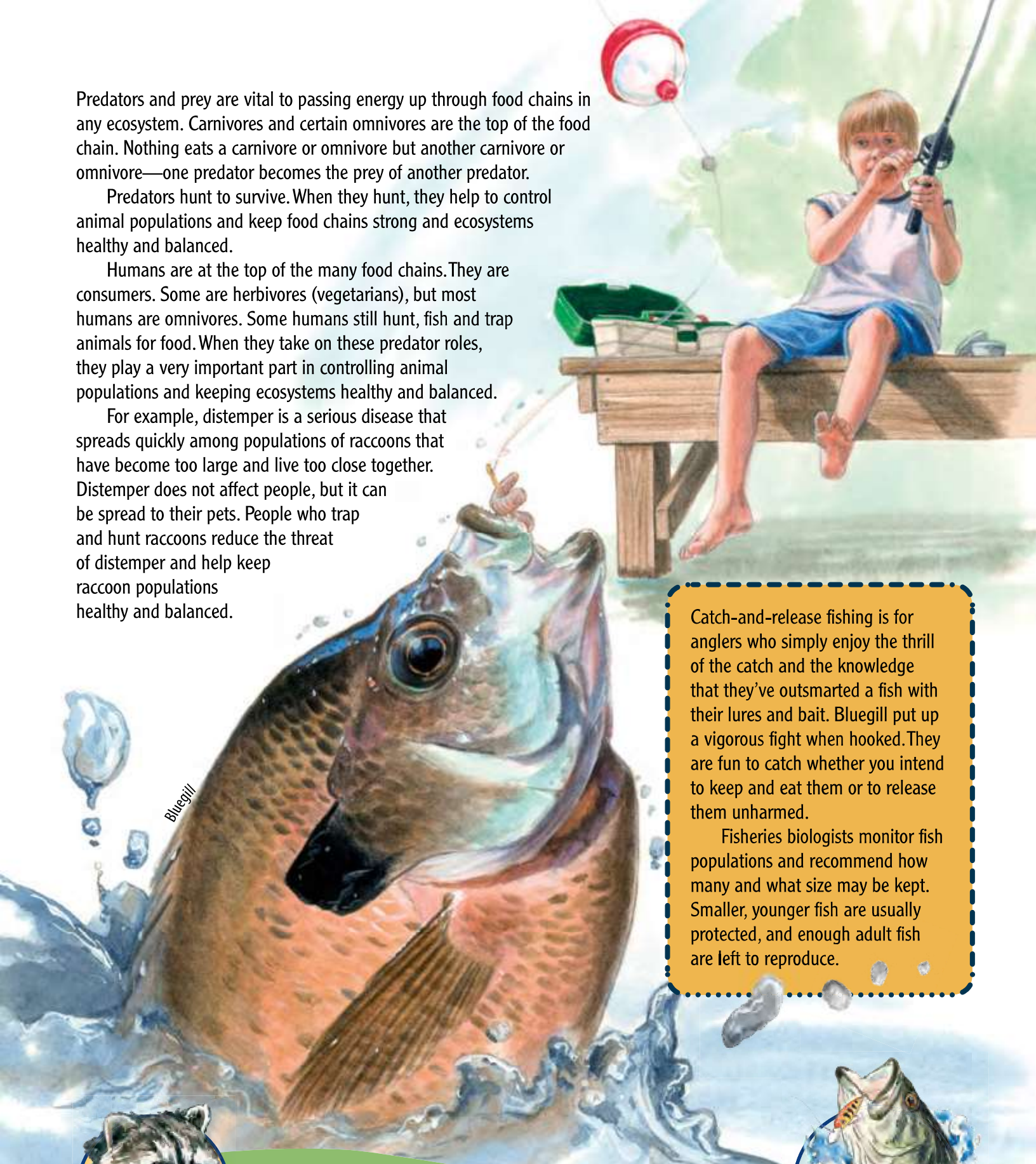
which is the predator and which is the prey?

Predators and prey are vital to passing energy up through food chains in any ecosystem. Carnivores and certain omnivores are the top of the food chain. Nothing eats a carnivore or omnivore but another carnivore or omnivore—one predator becomes the prey of another predator.

Predators hunt to survive. When they hunt, they help to control animal populations and keep food chains strong and ecosystems healthy and balanced.

Humans are at the top of the many food chains. They are consumers. Some are herbivores (vegetarians), but most humans are omnivores. Some humans still hunt, fish and trap animals for food. When they take on these predator roles, they play a very important part in controlling animal populations and keeping ecosystems healthy and balanced.

For example, distemper is a serious disease that spreads quickly among populations of raccoons that have become too large and live too close together. Distemper does not affect people, but it can be spread to their pets. People who trap and hunt raccoons reduce the threat of distemper and help keep raccoon populations healthy and balanced.



Bluegill

Catch-and-release fishing is for anglers who simply enjoy the thrill of the catch and the knowledge that they've outsmarted a fish with their lures and bait. Bluegill put up a vigorous fight when hooked. They are fun to catch whether you intend to keep and eat them or to release them unharmed.

Fisheries biologists monitor fish populations and recommend how many and what size may be kept. Smaller, younger fish are usually protected, and enough adult fish are left to reproduce.

While raccoons can be delicious, and many thousands are eaten each year, hunters and trappers also sell their pelts at auctions. A raccoon's thick, soft fur is used for coats and collars.

Largemouth bass are a popular freshwater game fish in Missouri. Anglers must check fishing regulations every year to see what size and how many they can keep.

How would you know if this fish is legal to keep?

summary

Predators hunt other animals for food. A prey animal is a predator's food, but there are animals that are both predators and prey. The speckled kingsnake on pages 26 and 27 is an example of an animal that is a predator when hunting the prairie vole for food but is also prey when hunted by the hawk. People who catch fish and hunt deer and turkey for food play the role of predator in an ecosystem.

Why do some people think of predators as fearsome and frightening animals and think of prey animals as gentle and cute?

Wild turkeys eat acorns as well as insects, seeds and other nuts. They spend much of the year in forests but choose open areas at the edge of forests or grasslands for nesting.

Spring turkey hunting not only provides an opportunity to harvest a turkey for food but also provides perfect opportunities to see early spring wildflowers and to sit quietly and still enough in the woods to observe songbirds and other forest animals up close.

Turkey

During the fall turkey hunting season, a young male (jake), an adult male (gobbler) or a female (hen) turkey may be harvested. During the spring turkey season, only jakes, gobblers or bearded birds may be taken to protect hens and their young.

SHARE THE HARVEST

As of 2008, hunters have donated more than 1.4 million pounds of venison (deer meat) to Missouri food pantries through the Share the Harvest program.

Large deer populations create serious driving hazards. Hunters help reduce deer numbers.

That's more than 5.6 million quarter pound burgers!

7 it all makes sense

Organisms live in ecosystems that provide them with the food, water, shelter, air and space they need to survive. Organisms change their behavior in response to internal and external cues in their environment. In this chapter, you will learn more about how organisms interact with and affect their environment and the other organisms in their environment. You will learn how these interactions help populations of organisms survive.

no, really, it *does* make sense

Hunger is one example of how an internal cue changes an animal's behavior. Hunger causes animals to forage for plants or hunt other animals. Other organisms are affected because they are the ones being eaten or because the hungry animal has eaten some of their food.

Plants affect the survival of animals, and animals affect the survival of plants. Plants must exchange pollen to develop fruits and seeds and eventually grow into new plants that will be food for herbivores and omnivores. Bees, butterflies and other insects are **pollinators**, animals that transfer pollen from one flower to another. Without these pollinators, many plants would not be able to reproduce.

Dragonflies lay their eggs along the stems of arrowhead and other emergent pond plants. Frogs lay a glob of eggs, and toads lay long strands of eggs directly in pond water. Once hatched, the young of dragonflies, frogs and toads find shelter and food among the plants.

Many plants depend on wind or animals to scatter or **disperse** their seeds. Some seeds have wing-like parts that allow them to spin down from the top of trees, and others with soft, fuzzy coverings are light enough to float away on the breeze. Seeds with sticky or prickly surfaces cling to animal fur and hitch a ride until they fall off or are scratched off. Where they land is where they can germinate and grow.

Bobwhite quail

Bobwhite quail sing their name: *bob WHITE, bob WHITE.* Groups of quail, called coveys, roost on the ground in a ring, birds facing outward, guarding against predators.

Quail live throughout the year in prairies that have both brushy areas and woodland edges. Bunches of prairie grasses make travel on the ground easier and safer. For quail, like all wildlife, survival is a year-round struggle with harsh winters and blazing hot summers, spring floods and summer drought.

Bumblebees buzzing about a prairie gather nectar from purple coneflowers. Each coneflower benefits from the visit because the bees leave behind bits of pollen they have collected in their **pollen baskets** from other purple coneflowers.

Some plants have seeds that will not germinate or grow unless they are eaten and passed through an animal's **digestive tract**. Migrating cedar waxwings gorge on berries in a grove of cedar trees. As the cedar waxwings continue their migration, the cedar seeds are digested and dropped from the birds. They distribute the digested seeds all along the migration route where many will grow.

Animals depend on plants as a source of food and energy, but they also use plants for shelter. Plants in ponds, forests and prairies offer places to hide from predators, places to rest and places to raise young or simply deposit eggs.

Animals living in forests and prairies find shelter and food among the roots, leaves and flowers of plants and trees. Fallen leaves from trees and plants blanket the forest floor and create a layer of safety and warmth for other plants and small animals. Thick clumps of prairie grass make perfect shelters and nesting spots for rodents, birds and snakes.

Prairie racerunners use flat rocks as shelter to hide from predators. Flat rocks are also important as places to warm up or cool down for prairie racerunners and other organisms.

Prairie racerunner

When is a rock not just a rock?

When it's an umbrella, a heating pad, a hideout or a home.

Prairie racerunners are very fast lizards. The warmer they are, the faster they run. Speed is their greatest defense, but long stripes on the prairie racerunner help keep predators wondering which way the speedy lizard is racing.

Big brown bats remain in Missouri all year. Hollow trees, deep rock crevices, buildings and caves are some of the places they use to roost and hibernate.

Survival often depends on being camouflaged and blending into an environment. Newborn deer are excellent examples of camouflage. White spots on their soft, brown fur allow fawns to blend into the forest. They remain hidden while their mothers forage for food. Thirteen-lined ground squirrels, greater prairie-chickens, ornate box turtles and bullsnakes are a few of the prairie animals with stripes, spots and bands of light and dark colors that help them blend into the prairie environment.

When animals try to protect themselves, they are responding to external cues and using **defense mechanisms** to interact with their environment. Venomous snakes and spiders use venom to protect themselves and to make their live food hold still. Skunks, daddy longlegs and certain snakes and insects have glands that give off such foul smells that other animals leave them alone. Specialized feet, tails and body shapes allow animals to run, jump and climb to escape other animals or to capture them.

Decomposers are essential to all animals and plants. Decomposers clean up scat and dead plant and animal material by breaking it down and returning it back into the soil as nutrients. Along with water, air and sunlight, these minerals and nutrients are used by plants to make their own food.

Striped skunk

How is a daddy longlegs like a skunk?

They both protect themselves by giving off bad odors.

When a skunk sprays, it uses two tiny hose-like structures that are connected to glands at the base of its tail. A skunk can aim its spray behind, to either side, or in front of itself by changing the direction of the hose-like structures and by twisting its body.

The spray is a thick, oily, greenish yellow fluid that has a strong, unpleasant odor and glows in the dark.

When startled by sound or movement, frogs use their strong back legs to jump back into the water or hop away quickly.

Daddy longlegs eat dead and decaying plants on the forest floor. They use their legs to touch, hear and smell.

Female rabbits have 2–4 litters of up to 9 young, called kits or kittens, in a year.

Old, fallen logs and dead plant matter on a forest floor are alive with sowbugs, carpenter ants, termites, beetles, fungi and bacteria consuming the dead matter and releasing it back into the soil as valuable minerals and nutrients.

Deep, rich soil is created when root systems of prairie plants are decomposed by microorganisms, which are too small to be seen without a microscope. Decomposers are part of the food chain and pass nutrients back to the plants. They are an environment's greatest recyclers.

Balance is the key to healthy ecosystems. Ecosystems may become unbalanced when populations of plants or animals become too large or too small as a result of droughts, floods or diseases. Populations of plants are eaten by herbivores. Populations of herbivores are eaten by carnivores. Populations of carnivores are eaten by other carnivores or omnivores. Balanced populations depend on an environment having enough food for all the animals as well as the right number of animals to eat the food.

When population numbers change, the balance between predator and prey changes. If the bobcat population suddenly became smaller, there would be fewer predators to eat rabbits. In a short time, rabbit populations would increase and consume too many plants. With fewer plants, eventually rabbits and other plant consumers would not have the food they needed to survive.

Summary

Organisms interact with other organisms and the environment by seed dispersal, pollination, camouflage and defense mechanisms. A decrease in prey populations can cause a decrease in predator populations. A decrease in predator populations can cause an increase in prey populations. Different organisms survive in a given environment because they have special structures or behaviors.

Humans are part of the picture, too.

Cottontail rabbit

When humans visit a prairie and dig up large numbers of wildflowers, they are removing essential pieces of prairie ecosystems. Rabbits, butterflies, birds and other herbivores that depend on those forbs for food and shelter may have more difficulty surviving. Bobcats, coyotes, hawks and other predators that depend on those herbivores for food are affected.

Fishing regulations help balance predator/prey populations. Taking fish smaller than the legal length limit reduces the number of fish old enough to reproduce.

Riding an ATV through forests can damage plants and homes of burrowing or ground-nesting animals.

Litter is ugly. It can also be a health hazard for humans and other animals.

8 humans are organisms, too

Organisms, populations of organisms and communities of populations all interact with each other and with the non-living elements in their environment. In this chapter, you will learn how humans fit into this picture and how they impact organisms and ecosystems in both beneficial and harmful ways.

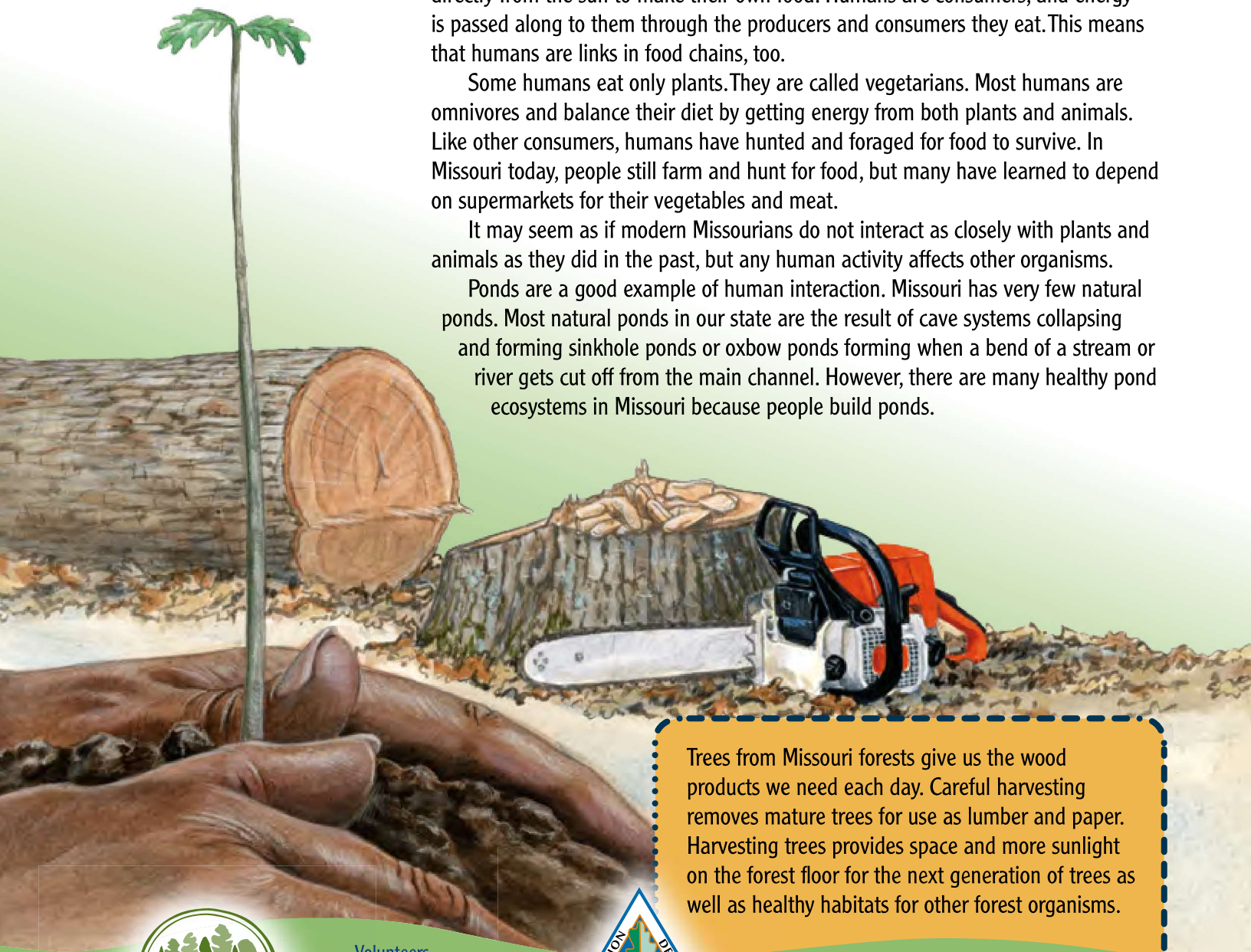
links in the chain

Humans are organisms. They are not producers because they cannot use energy directly from the sun to make their own food. Humans are consumers, and energy is passed along to them through the producers and consumers they eat. This means that humans are links in food chains, too.

Some humans eat only plants. They are called vegetarians. Most humans are omnivores and balance their diet by getting energy from both plants and animals. Like other consumers, humans have hunted and foraged for food to survive. In Missouri today, people still farm and hunt for food, but many have learned to depend on supermarkets for their vegetables and meat.

It may seem as if modern Missourians do not interact as closely with plants and animals as they did in the past, but any human activity affects other organisms.

Ponds are a good example of human interaction. Missouri has very few natural ponds. Most natural ponds in our state are the result of cave systems collapsing and forming sinkhole ponds or oxbow ponds forming when a bend of a stream or river gets cut off from the main channel. However, there are many healthy pond ecosystems in Missouri because people build ponds.



Trees from Missouri forests give us the wood products we need each day. Careful harvesting removes mature trees for use as lumber and paper. Harvesting trees provides space and more sunlight on the forest floor for the next generation of trees as well as healthy habitats for other forest organisms.

MISSOURI FORESTKEEPERS NETWORK

Volunteers adopt sections of forests and keep records of the forest's health.

CONSERVATION DEPARTMENT MISSOURI

Volunteers across the state teach hunter education classes, work at shooting ranges, and help at nature centers.

Even in cities, humans interact with and affect other organisms in their environments. People who put out bird feeders, bird baths and bird houses provide food, water and shelter for Missouri birds. People who plant native flowers and grasses provide food and shelter for birds, insects and many other animals.

People work together to bring parks and hiking trails back into their cities. These green spaces provide habitat for native trees and other plants and attract birds, butterflies, rabbits, foxes and many other organisms necessary for a healthy ecosystem.

Hunting and fishing are ways for humans to interact with their environment just as other predators do. The Missouri Department of Conservation studies animal populations and then sets rules and regulations for people to follow when they hunt, trap or fish. Harvesting animals, such as deer, turkey, raccoons and fish, according to these rules and regulations has a **beneficial effect** on the ecosystem. Careful hunting, trapping and fishing helps to manage and balance wildlife populations.

Hiking, bird watching, butterfly watching, mushroom hunting and outdoor photography are other ways humans enjoy and interact with other organisms in different ecosystems.

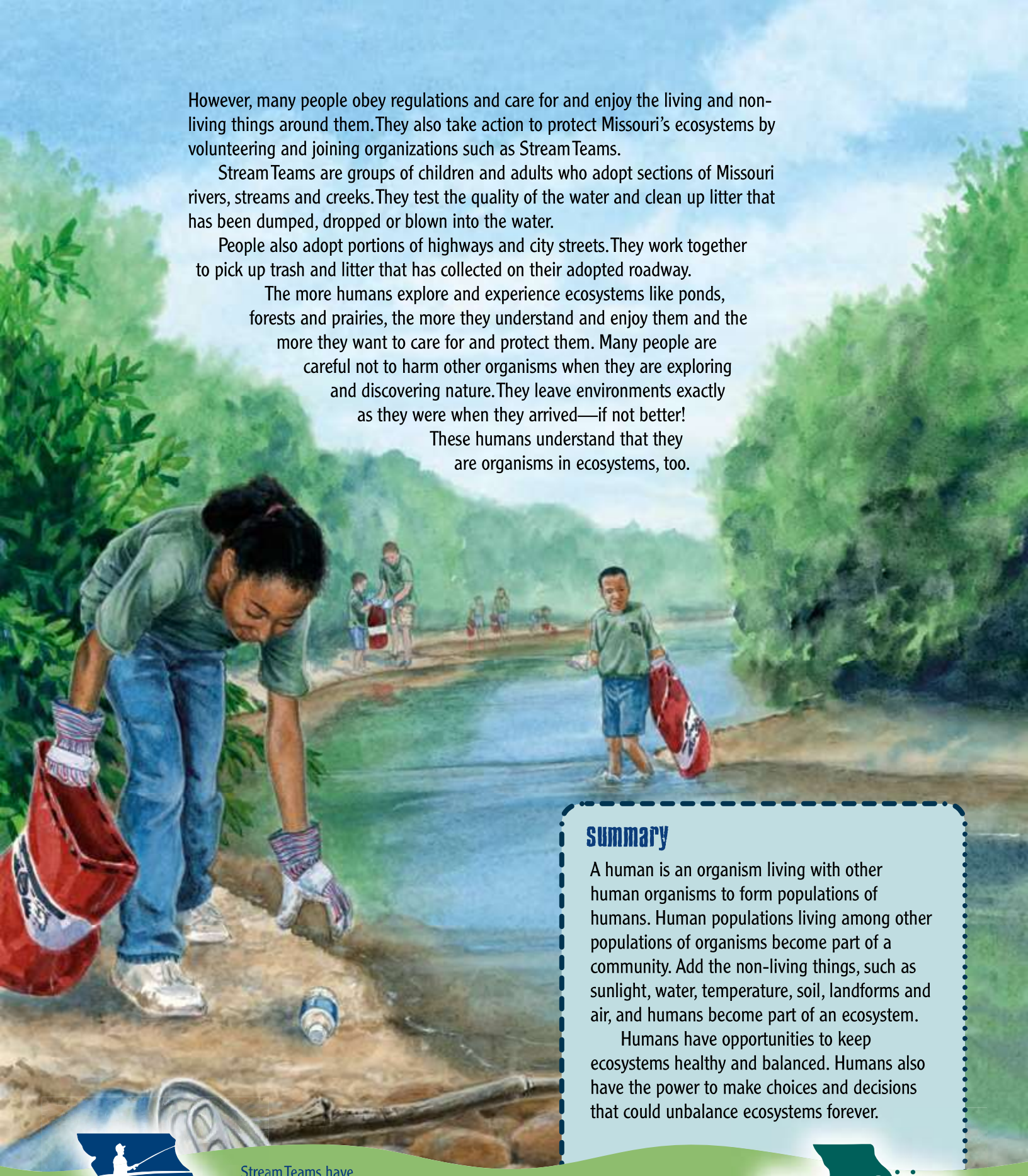
Unfortunately there are human activities that have **harmful effects** on other organisms. When people carve their initials on the bark of a tree, the carving leaves the tree's trunk open to disease and insects. People who hike or ride ATVs, bicycles or horses off marked trails through streams, forests and prairies can damage these ecosystems. Some people litter, and litter is not only harmful to organisms and their environment, it is also ugly.

Humans have opportunities to keep ecosystems healthy and balanced. Humans also have the power to make choices that could unbalance them forever.

OPERATION GAME THIEF
Wildlife in Missouri belong to the people of Missouri. One way people can protect wildlife is to report **poachers**. Call 1-800-392-1111.

Missouri Master Naturalist™

Volunteers work in their local communities to improve the land for native plants and wildlife.



However, many people obey regulations and care for and enjoy the living and non-living things around them. They also take action to protect Missouri's ecosystems by volunteering and joining organizations such as Stream Teams.

Stream Teams are groups of children and adults who adopt sections of Missouri rivers, streams and creeks. They test the quality of the water and clean up litter that has been dumped, dropped or blown into the water.

People also adopt portions of highways and city streets. They work together to pick up trash and litter that has collected on their adopted roadway.

The more humans explore and experience ecosystems like ponds, forests and prairies, the more they understand and enjoy them and the more they want to care for and protect them. Many people are careful not to harm other organisms when they are exploring and discovering nature. They leave environments exactly as they were when they arrived—if not better!

These humans understand that they are organisms in ecosystems, too.

summary

A human is an organism living with other human organisms to form populations of humans. Human populations living among other populations of organisms become part of a community. Add the non-living things, such as sunlight, water, temperature, soil, landforms and air, and humans become part of an ecosystem.

Humans have opportunities to keep ecosystems healthy and balanced. Humans also have the power to make choices and decisions that could unbalance ecosystems forever.

MISSOURI STREAM TEAM

Stream Teams have picked up nearly 11,200,000 pounds of trash from streams, rivers and creeks. It would take 1,400,000 gallons of milk to weigh that much.

When kids pick up litter (and remind others not to litter), they interact with and affect their environment in a positive way.

No MORE Trash!

more to explore

caves, wetlands, streams and glades

more to explore...

cave ecosystem

Caves are dark and mysterious ecosystems. Caves are openings in the earth formed by underground waters. The cave-forming process takes thousands of years and continues today. Caves could have many miles of passageways or extend just a few feet underground. Missouri has so many caves it has been called The Cave State.

Common features of most true caves include an average temperature of 12.7–14.4 degrees Celsius (55–58 degrees Fahrenheit) all year, total darkness and no producers in the form of green plants.

Big brown bats sounds vary from long, drawn-out, deep, raspy notes to quick, separate squeaks and clicks that can be heard by humans. Bats communicate with each other by chattering, and young bats squeak to call their mothers. Big brown bats also use ultrasonic cries while flying which help them avoid objects and hunt and chase prey. These sounds cannot be heard by humans.

cave entrances

plants and animals

Walking fern and mosses are green plants that can grow in cool, low-light places where there is some sunlight. They are often found around cave entrances. Eastern phoebes are birds that often build nests in the entrance zone of caves, and vultures often use cave entrances to raise their chicks. Snakes use entrance areas to cool down on hot summer days and to hibernate through the cold winter months. Spiders can be found near cave entrances, and daddy longlegs cluster in dark, moist places near the entrance but leave the cave at night to feed on decaying plants and animals. Small insects and tiny decomposers break down leaf litter, small logs, sticks and other bits of organisms that have blown or floated into the cave.

cave twilight zones

plants and animals

The twilight zone is beyond the cave entrance and is usually not long. Turns in the cave passageway eventually block all light coming from the entrance. Once all light is blocked, the passageway leads into the zone of total darkness. Few green plants can live in the twilight zone, and none could survive any deeper in a cave. Certain toads, frogs and salamanders as well as cave crickets and wood rats can be found in and often just beyond the twilight zone. Many of these leave the cave to feed or mate, and some only use the cave during certain seasons.

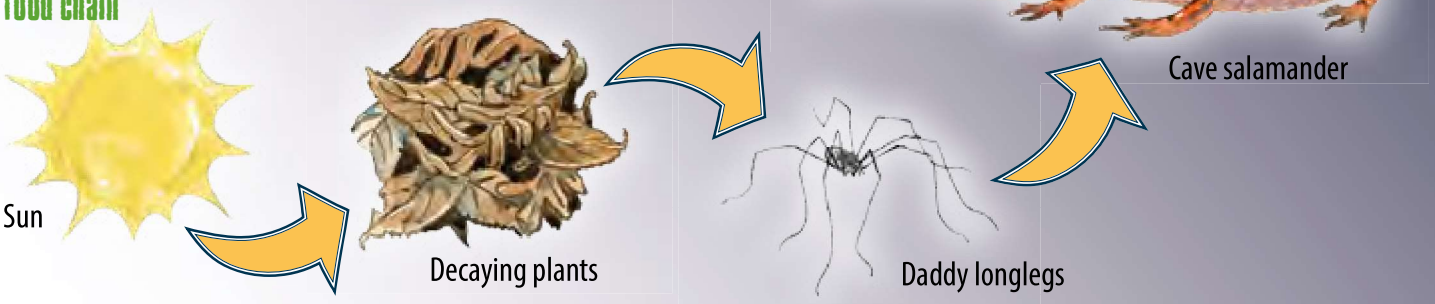
A cave salamander will wave its tail in an effort to distract a predator's attention away from its head.

What could possibly survive in total darkness when energy for organisms in ecosystems begins with the sun and producers?

An entire cave is not in total darkness. Many small bits of sun-loving animals and plants may be washed or blown into a cave.

cave entrance or twilight zone

food chain



cave dark zone

plants and animals and specialized structures

Cave areas in total darkness are called the dark zones. Few animals live their entire lives in these deepest, darkest cave zones. Animals that do live in the total darkness of caves have specialized structures to help them survive. Cavefish, grotto salamanders, and cave crayfish live in total darkness and have no need for eyesight or coloration in their skin or exoskeleton to protect them from sunlight. Ozark cavefish and southern cavefish have no color in their skin and are the only Missouri fish without eyes. Their bodies use energy very slowly, which allows them to go long periods of time without food. The pinkish-white grotto salamander adults have eyes that are tiny, partly or completely blind, and covered with a filmy skin. Cave crayfish have longer legs and antennae than non-cave dwelling crayfish. They also are completely blind or even eye-less. However, cave crayfish, cavefish and grotto salamanders have sensory structures, other than eyes, that help them find food.

Bats are the organisms most often connected with caves. Many bats spend most of their time roosting in forests, barns and other types of buildings, but some are more likely to use caves as roosting places either alone or in huge, tight clusters with hundreds of other bats. Some species use caves only during the summer. Others use caves only in the winter to hibernate. Some use caves all year. All bats are cave visitors and, unless they are hibernating through the winter, will leave the cave at night to search for food.

Without sunlight and green plants to begin food chains, deep cave-dwelling animals such as cavefish, cave crayfish and grotto salamander depend on food sources brought into caves by seasonal floods, bats or other cave-visiting organisms. Bat scat, called guano, provides nutrients for bacteria, fungi and the small animals that feed on those decomposers. Decaying leaves and twigs blowing in through cave entrances or washing in through cracks in cave ceilings also provide nutrients and small organisms for food.

cave dark zone food chain

Sun ➲ decaying plants (washed into the cave) ➲ small insects ➲ small cave crayfish ➲ cavefish

humans and caves

Caves are fragile ecosystems, and what happens on the land's surface affects the cave life below. Run-off from pesticides, fertilizer and pollution finds its way easily into cave systems. Humans often break off and destroy delicate cave formations or disturb hibernating bats or bat nurseries in caves. Smoking and littering harm cave ecosystems.

However, humans have taken steps to protect caves, cave animals and the water quality of cave streams by putting up locks, gates and doors on several protected caves and by passing laws against trespassers and those creating problems with water pollution in caves.

When the tip of a walking fern **frond** touches moist soil, a new fern grows making it seem as if the fern is walking across the ground.

Grotto salamanders begin their lives in upland springs and streams, but spend their adult life in the darkness of caves.

more to explore...

wetland ecosystem

Mallard ducks are omnivores and eat a wide variety of foods, including plants, insects, worms, snails and crayfish. Humans, raccoons, coyotes and owls are some of the predators that eat mallards.

A wetland is an ecosystem where water makes all the difference. Water controls the environment and all the plant and animal life in it. Wetlands are bodies of shallow, standing water that stay wet for at least part of the year. Swamps, bogs, marshes and fens are examples of wetlands. Water, special soil and water-loving plants are the necessary features of wetlands.

plants and animals

Wetlands are some of the richest ecosystems in Missouri. Many plants and animals, including rare and endangered species, live in and depend on healthy wetlands. Water-loving wetland trees include black willow, bald cypress and tupelo. Cattail, arrowhead, buttonbush, blue flag and duckweed are plants found in Missouri wetlands. Animals that use wetlands for the food, water, shelter and space they need to survive include muskrats, beaver and raccoons; bald eagles, red-winged blackbirds and many kinds of ducks; turtles and snakes; green sunfish and bullhead catfish; mussels, snails and crayfish; dragonflies, whirligig beetles and predacious diving bugs. Some animals live in a wetland all year; others visit wetlands throughout the year.

Decomposers play an important role in wetlands by breaking down dead plants and animals into a rich, spongy soil. This rich wetland soil acts like a sponge soaking up and storing water. It protects against flooding during rainy weather by soaking up the water and then slowly releasing it into rivers and streams. Wetland plants and wetland soil filter out pollutants as water slowly passes through them.

How is a wetland like a restaurant and motel?

Migrating waterfowl use them to rest and to find food.

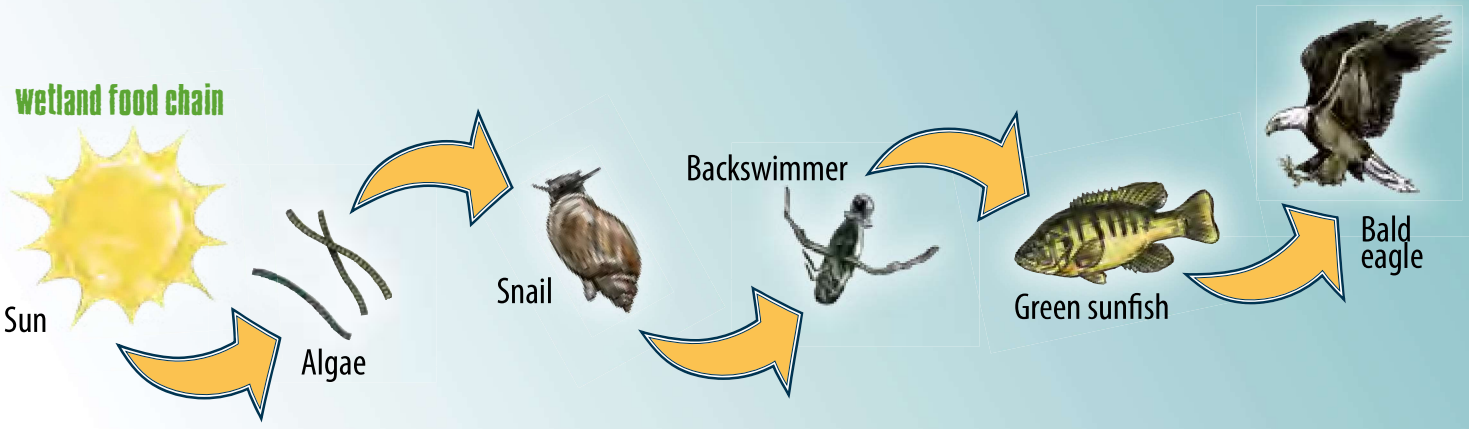
specialized structures

Wetland plants have specialized structures that help them absorb oxygen even in dark, murky water. Many wetland plants have wide trunks or big roots near the water's surface to help them absorb oxygen from the air, and their large leaves take in energy from the sun. Cattails, arrowheads and buttonbush grow tall and grow above other plants to reach sunlight.

Bald eagles are often found near wetlands. In 2008, they were removed from Missouri's list of endangered species.

Northern water snakes may move onto land but never go far from water.

wetland food chain



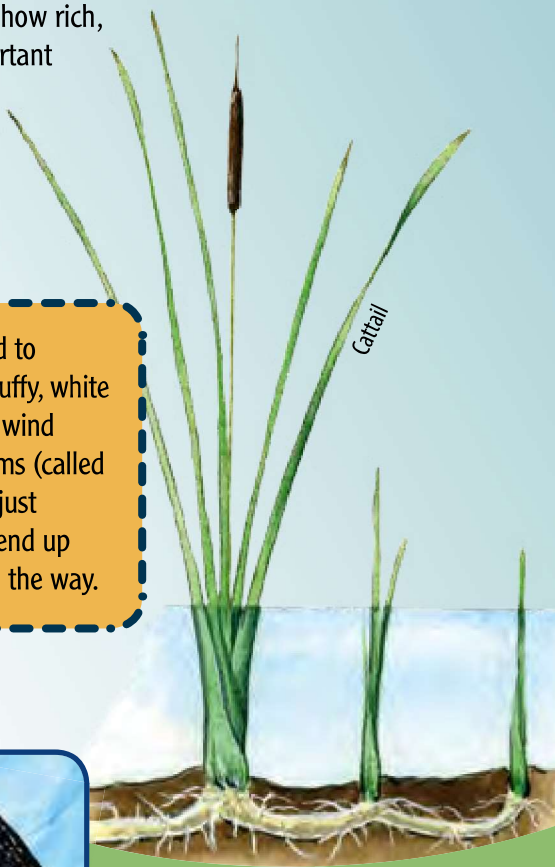
Wetland animals have their own specialized structures. Whirligig beetles have special mouthparts for chewing organisms or debris they find on the surface of the water. Bald eagles have sharp talons and sharp, curved beaks for grasping and tearing fish, water birds and dead animals. Least bittern have long legs and long, spread out toes like great blue herons. These specialized structures keep them from sinking into the soft, spongy mud. Least bittern also have feather colors that camouflage them among the tall wetland grasses. Northern water snakes are camouflaged by the spots and bands of color of their scales.

humans and wetlands

Native Americans hunted the great flocks of ducks and geese that migrated through wetlands. They cut and wove cattails into mats, baskets and other items for their homes. Wetland muskrat, beaver and river otter were trapped for their fur and used by Native Americans for clothing and for trade items. Native Americans were careful not to overharvest wetland plants and animals. Their careful interaction with other organisms in the wetland ecosystem kept the ecosystem healthy and balanced.

Today, some people drain wetlands because they think wetlands are wasted land or land that could be put to better use as farmland or for highways and housing. When wetlands are drained, all the organisms that depended on them lose what they needed to survive.

However, many people today understand that wetlands are more than homes for plants and wildlife. They know that wetlands filter pollutants and waste from the water, help control flood waters and are the most productive ecosystems in the world. Hunters, birdwatchers, anglers, hikers and many others enjoy wetlands. They see how rich, beautiful and important balanced wetlands are and work to protect them.



Cattails use air and mud to reproduce. Their small fluffy, white seeds blow away in the wind while their root-like stems (called **rhizomes**) grow along just beneath the mud and send up new cattail plants along the way.

Male red-winged blackbirds fiercely defend their wetland nesting territory during the breeding season. They will even attack much larger animals, including horses and people.

Whirligig beetles normally live on the surface of the water and swim rapidly in circles when disturbed.

more to explore...

stream ecosystem

Green heron mainly eat small fish and frogs. They are one of the few tool-using birds and will drop insects, earthworms, twigs or feathers onto the surface of the water and grab the small fish that are attracted by this bait.

A stream is a body of flowing water like a brook or small river. Missouri streams do not all look the same. They differ in size, shape and length. They differ in how fast or slow they flow and in the quality of the water. A single stream ecosystem can be home to thousands of different plants and animals.

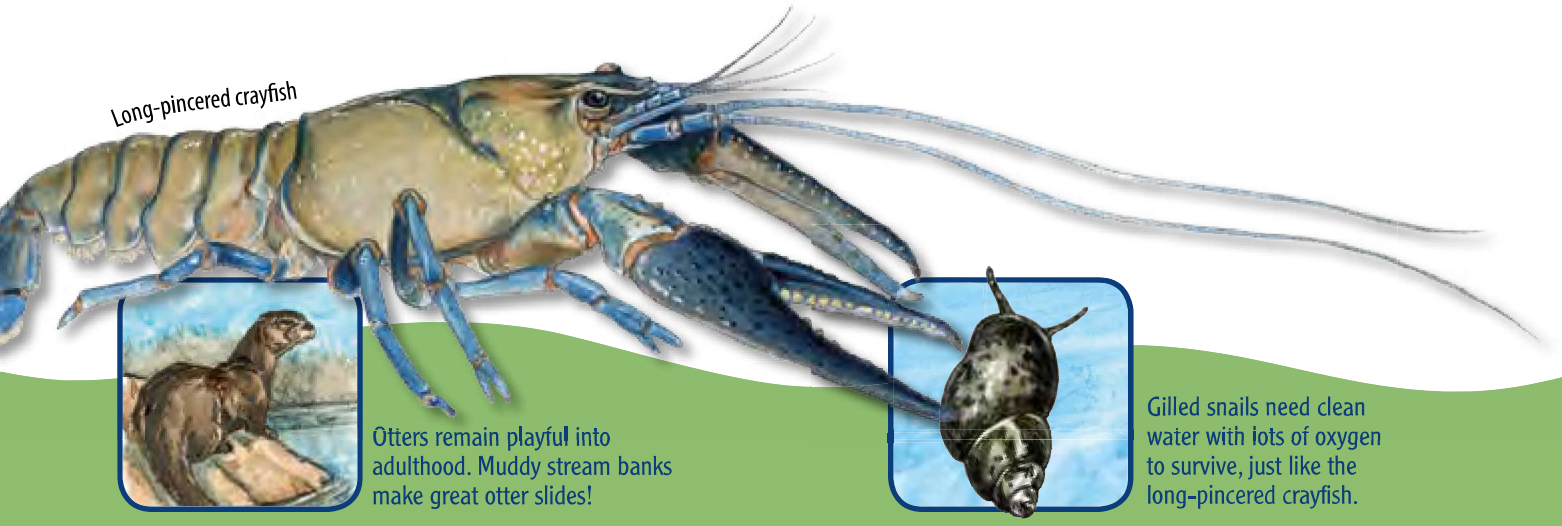
Streams share some characteristics. The largest amount of a stream's water flows in the channel. Channels change when streams flood and more water flows through. Riffles are bubbly sections of shallow streams where water flows swiftly over rocks. The rocks provide nooks and crannies for aquatic insects to hide and find food. The riffle bubbles add oxygen to the water.

Streams also have areas of deeper, slower, calmer water called pools. Pools may form behind boulders and large, twisted roots of fallen trees. Pools provide fish with shelter, food and a place to rest.

Flood plains are areas on either side of streams that hold flood water. The riparian zones are wide sections of trees, shrubs and other plants that grow along streams. The roots of these plants help keep soils and chemicals from washing into the streams. The health of a stream depends on the makeup of the watershed. A watershed includes all the land that brings rainwater to a stream.

plants and animals

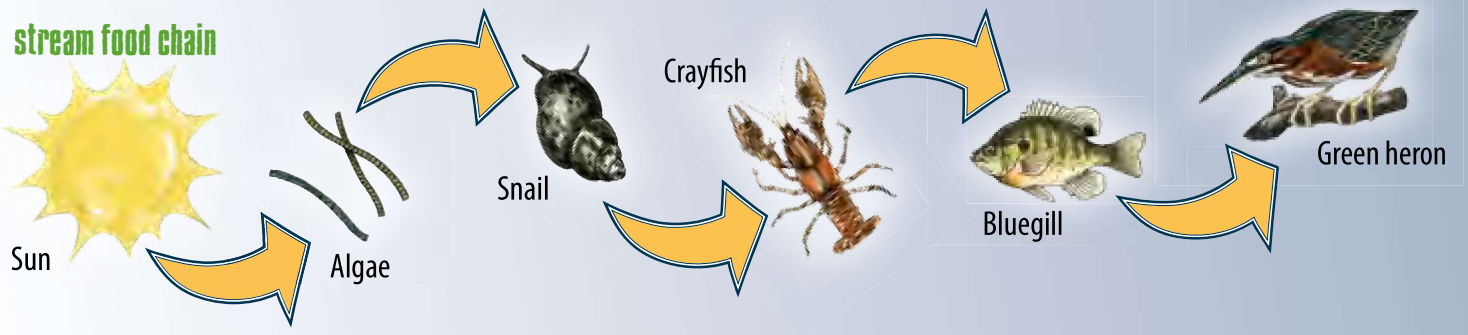
Where a stream is shallow enough for sunlight to reach the bottom, algae is able to grow and provide food for herbivores such as bullfrog tadpoles and gilled snails living in the stream. Plants that grow in and along streams, such as cattails, blue flag and river bullrushes, have long, thin, flexible stems that move easily with the stream current but have roots strong enough to hold them in place. Healthy streams are usually lined with trees such as black willow, sycamore and cottonwood that thrive in wet, moist areas. The roots of trees along



Otters remain playful into adulthood. Muddy stream banks make great otter slides!

Gilled snails need clean water with lots of oxygen to survive, just like the long-pincered crayfish.

stream food chain



streams hold the soil of the stream bank in place. The roots and the rest of the tree parts provide shelter and food for many different stream ecosystem organisms.

Turtles, tadpoles, frogs, hellbenders, fish, crayfish, snails and aquatic insects live in different stream areas. Snakes, raccoon and deer are frequent stream visitors seeking water or food. River otter have dens along stream banks but spend much of their time in the water hunting and chasing their food. Their streamlined bodies; webbed feet; long, tapering tails; ears and noses that close when underwater; and eyes near the top of their head are specialized structures that make them more comfortable and graceful in the water than on land.

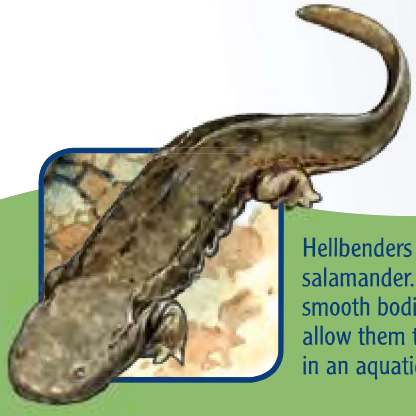
specialized structures

Other specialized structures that help animals survive in a stream ecosystem include the long, thin legs of green heron used for wading and the webbed feet of wood ducks and river otter for swimming. Snails have broad, flat foot-like parts that help them stick to rocks. Freshwater mussels and clams filter tiny food particles out of water drawn in through one of their two tube-like structures and out the other.

humans and streams

Humans harm streams by allowing pesticides, fertilizer and litter to wash off fields and roads and enter streams. Can you guess what the number one form of water pollution is? It's soil! When trees and other plants of riparian zones are reduced or removed, there is nothing left to stop soil from falling from the edges of streams. Humans also affect streams and stream organisms when they dig up gravel from stream bottoms.

People enjoy fishing, canoeing, birdwatching and swimming on Missouri's streams. People often bring along trash bags in case they find litter while playing in a stream. Many people help keep Missouri stream ecosystems healthy by joining Stream Teams. Stream Teams pick up stream litter and collect data on the organisms that live and grow in and around streams.



Hellbenders are Missouri's largest salamander. Their flat heads and long, smooth bodies are structures that allow them to survive comfortably in an aquatic ecosystem.

An orangethroat darter's smaller-than-normal swim bladder holds less air and allows the darter to sink and hover easily near the bottom of a stream.

more to explore...

glade ecosystem

If caught in an open area, eastern collared lizards will often run very quickly on their hind legs with the forward part of their body held upright to escape. They eat a variety of insects such as grasshoppers, beetles and moths as well as spiders, small snakes and other lizards.

Glades are dry, hot and sunny and formed where layers of rock cut through the soil. Glades usually are small, rocky openings on hills in forests, woodlands and prairies. They are rare, delicate, desert-like ecosystems found in Missouri.

plants and their specialized structures

Glade coneflowers, bladderpod and bottlebrush blazing star are only found in glade ecosystems. Other plants that are able to grow on glades include prickly pear cactus, prairie dock, black-eyed Susan, lichens and mosses.

Lichens are a combination of a fungus and algae. The fungus provides water and nutrients, and the algae is a producer that uses energy from the sun to make food for both the algae and the fungus.

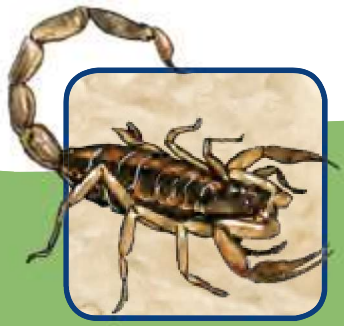
Glade plants have specialized structures that allow them to survive in such a desert-like environment. Many glade plants have seeds that stay dormant and won't sprout and grow for many years until the right amount of soil and water becomes available. Prickly pear cactus stores water in its thick leaves and uses that water during dry periods. Its fruit is red, bristly, shaped like a pear, and can be eaten. Prairie dock has long roots that wind through cracks in rocks seeking water deep down in the ground.

animals and their specialized structures

Glade animals have specialized structures, too. Tarantulas are Missouri's largest spiders. These carnivores defend themselves by biting and injecting venom and by releasing irritating hairs into the eyes of predators. Collared lizards prey on spiders, insects, small snakes and other lizards, and when threatened, collared lizards escape by running upright on their hind legs. Special lines camouflage the striped scorpion, and markings and colors on lichen grasshoppers help them blend into the lichen-covered glade rocks. Greater roadrunners can fly but usually use their strong legs to chase their prey. They hold their head and tail flat and parallel to the ground when running at top speed. Roadrunners eat many venomous prey items, including scorpions, spiders and rattlesnakes as well as non-venomous insects, small reptiles, rodents and small birds.

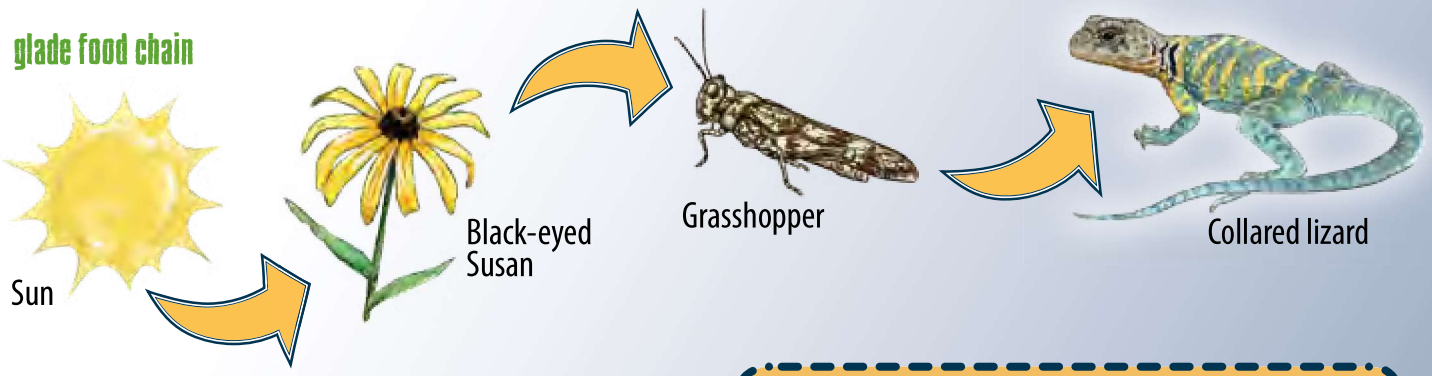
Glade plants use the sun's energy to make their own food. They use the soil to get nutrients. Glade rocks are important non-living things in a glade. They provide

Cactus do grow in Missouri—prickly pear cactus! Watch out for its sharp spines and bristles.



A striped scorpion uses the sharp stinger at the end of its tail to inject venom into its prey. The sting is painful, but not usually dangerous to humans.

glade food chain



shelter from heat and predators. Tarantulas hunt for insects at night but hide during the day in rocky crevices. Collard lizards warm themselves on the glade's flat rocks and crawl under them to hide and to cool off. Striped scorpions are nocturnal carnivores and spend the night hunting spiders, crickets, beetles and sometimes even small mice and lizards.

humans and glades

Glade ecosystems are easily disturbed. Plants that survive in thin, dry soil are sensitive and easily trampled and crushed by careless hikers, horseback riders, mountain bikers and ATV riders. People who remove glade rocks reduce the amount of shelter for glade animals from heat and predators.

People who study and enjoy these special and delicate glade ecosystems know that fire is a vital non-living part of healthy glades. Cedar trees block sunlight from glade plants. Fire burns off cedar trees and other non-glade plants and keeps the area open to sunlight and heat. Glade plants may be burned during a fire, but they grow back quickly and stronger. People manage and protect glade ecosystems by burning and cutting cedars. Left unburned, glades, like prairies, eventually become woodlands and forests.

Common nighthawks feed mostly at dusk and dawn on flying insects. They are drawn to wide open areas such as glades but are often seen in cities and towns catching insects attracted to parking lot lights at night. Bristles surrounding the nighthawk's enormous mouth are specialized structures that allow it to capture insects while it flies. Its lower jaw is shaped in such a way that a nighthawk can drink while it flies, skimming the water surface.

Nighthawks migrate to South America for the winter. On early summer evenings when you hear their *peent* call, look up and try to catch a glimpse of the white bars on their long, bent wings and their darting, acrobatic hunting flight.

Greater roadrunners can reach running speeds of over 18 miles per hour.

Lichens can grow on bare rock and in harsh environments. Two species of lichen were sent up in a rocket and exposed to the vacuum of space. They returned to earth completely unharmed!

glossary


Gray fox

ab·do·men (**ab**-duh-muhn) *noun* — 1.The part of the body between the chest and the hips including the cavity in which the chief digestive organs lie. 2.The hind part of the body of an arthropod (as an insect).

al·gae (**al**-jee) *noun, plural* — Small plants without roots or stems that grow in water or on damp surfaces.

a·qua·tic (uh-**kwat**-ik or uh-**kwot**-ik) *adjective* — Living or growing in water, as in *aquatic plants and animals*

ben·e·fi·cial (ben-uh-**fish**-uhl) *adjective* — Something that is good.

ben·e·fi·cial ef·fect (ben-uh-**fish**-uhl uh-**fekt**) *noun* —The result or consequence of something good.

cam·ou·flage (**kam**-uh-flahzh) **—** 1. *noun:* Coloring or covering that makes animals, people, and objects look like their surroundings. 2. *verb:*To disguise something so that it blends in with its surroundings.

can·o·py (**kan**-uh-pee) *noun* —The top layer of a forest including the branches and leaves of the tallest trees.

car·ni·vore (**kar**-nuh-vor) *noun* — An animal that eats other animals; an animal that eats meat.

cave (**kayv**) *noun* — A natural hole underground or in the side of a hill or cliff; an opening in the earth caused by rock dissolving or collapsing.

chan·nel (**chan**-uhl) *noun* — 1. A narrow stretch of water between two areas of land. 2.The deeper part of a waterway.

com·mu·ni·ty (kuh-**myoo**-nuh-tee) *noun* — A group of different populations of plants and animals living in the same place at the same time and interacting with one another.

con·i·fer (**kon**-uh-fur or **koh**-nuh-fur) *noun* — An evergreen tree that produces cones.

con·i·fer·ous (kun-**nif**-ur-uhss) *adjective* — Cone-bearing trees or shrubs that do not lose their needles or leaves in the fall.

con·ser·va·tion (kon-sur-**vay**-shuhn) *noun* — Careful use of valuable things, especially forests, wildlife and natural resources.

con·su·mer (kuhn-**soo**-mur) *noun* — Organisms that eat other organisms to get the energy they need to survive; living thing that eats other living things for food.

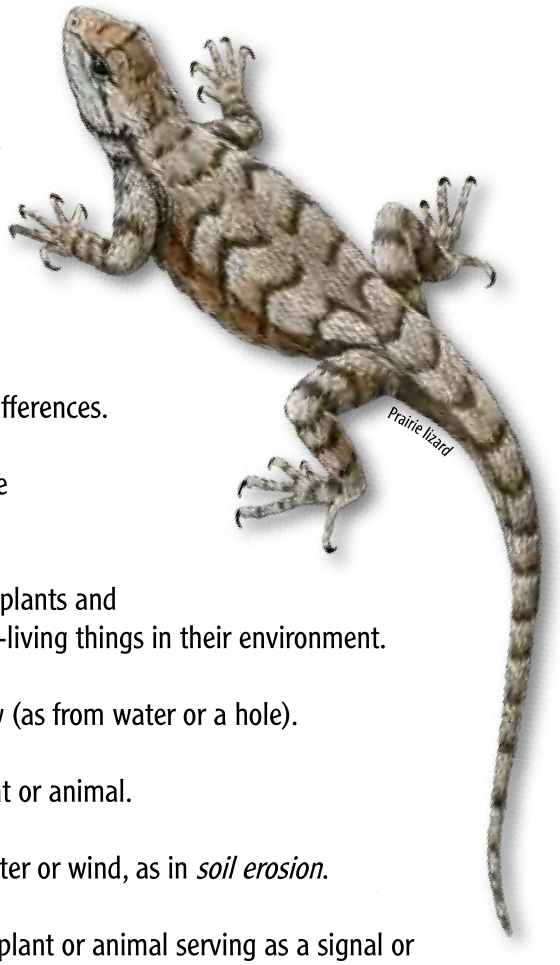
de·cid·u·ous (di-**sij**-oo-yhss) *adjective* —Trees or shrubs that lose leaves in the fall and grow new ones in the spring.

de·com·pos·er (dee-kuhm-**poze**-ur) *noun* — An organism that feeds on and breaks down dead plant and animal matter, which provides nutrients for other plants and animals.


Bobwhite quail

de·fense mech·an·ism (di-**fenss mek**-uh-niz-uhm) *noun* — Different ways organisms are protected or react to protect themselves from other organisms such as camouflage, mimicry, warning colorations or attack.

di·ges·tion (duh-**jess**-chuhn) *noun* — The process of breaking down and changing food in the stomach and other organs into simpler forms that can be absorbed into the blood and used by the body for growth.


Prairie lizard

di·ges·tive (duh-**jess**-tiv) *adjective* — Relating to digestion and the process of changing food into simpler forms that can be taken in and used by the body.

di·ges·tive tract (duh-**jess**-tiv **trakt**) *noun* — A group of parts or organs in the body that perform specific functions of digestion.

dis·perse (diss-**purss**) *verb* — To scatter.

di·ver·si·ty (di-**vur**-suh-tee) *noun* — A variety or assortment; having many differences.

dor·mant (**dor**-muhnt) *adjective* — An inactive state when plants or seeds are alive but not growing.

e·co·sys·tem (**ee**-koh-siss-tuhm or **ek**-oh-siss-tuhm) *noun* — Populations of plants and animals living together in communities and interacting with the living and non-living things in their environment.

e·merg·ent (i-**murj**-uhnt) *adjective* — Something that comes out or into view (as from water or a hole).

en·vi·ron·ment (en-**vye**-ruhn-muhnt) *noun* — Immediate area around a plant or animal.

e·ro·sion (i-**roh**-zhuhn) *noun* — The slow wearing away of a substance by water or wind, as in *soil erosion*.

ex·ter·nal cue (ek-**stur**-nuhl **kyoo**) *noun* — Something on the outside of a plant or animal serving as a signal or suggestion to change behavior.

flex·i·ble (**flek**-suh-buhl) *adjective* — Able to bend.

flood plain (**fluhd plane**) *noun* — An area of low land near a stream or river that becomes flooded during heavy rains.

food chain (**food chayn**) *noun* — The transfer of food energy from one organism to another beginning with energy from the sun to producers to consumers.

for·age (**for**-ij) *verb* — To search for food.

forbs (**forbz**) *noun* — Wildflowers.

for·est (**far**-ist or **for**-ist) *noun* — An area of land covered mostly with trees and other plants.

for·est e·co·sys·tem (**far**-ist or **for**-ist **ee**-koh-siss-tuhm) *noun* — Populations of plants and animals living together in communities and interacting with other organisms and non-living things in a forest.

for·est floor (**far**-ist or **for**-ist **flor**) *noun* — Lowest layer of a forest covered with low-growing plants and mosses plus layers of decaying leaves, fallen trees and branches that add nutrients to the soil.

frond (**frond**) *noun* — Large, divided leaf of a plant such as a fern or palm.

glade (**glade**) *noun* — Dry, hot, sunny areas where only certain plants and animals can survive; usually small, rocky openings on hills in forests, woodlands and prairies.

gua·no (**guah**-noh) *noun* — Scat, feces, droppings from bats.

harm·ful (**harm**-ful) *adjective* — Something that injures or hurts.

harm·ful ef·fect (**harm**-ful uh-**fekt**) *noun* — The result or consequence of something causing injury or hurt.

har·vest (**har**-vist) *verb* — To hunt or gather food or trees for human use.

her·bi·vore (**hur**-buh-vor) *noun* — An animal that eats only plants.

hi·ber·nate (**hye**-bur-nate) *verb* — To spend the winter resting; condition where the body system slows down to save energy.

hi·ber·na·tion (**hye**-bur-nay-shun) *noun* — The act of spending the winter in a deep sleep with slower body functions.

in·stinct (**in**-stingkt) *noun* — Behavior that is natural rather than learned.


Wooly bear caterpillar

in·ter·act (in-tur-**akt**) *verb* — To act upon one another.

in·ter·ac·tion (in-tur-**ak**-shun) *noun* — Having an influence on something.

in·ter·nal cue (in-**tur**-nuhl **kyoo**) *noun* — Signal from inside a plant or animal that causes a change in behavior.

land·forms (**land**-formz) *noun* — Natural features on earth such as mountains, hills, valleys, plains and canyons.

liv·ing (**liv**-ing) *adjective* — The condition of being alive.

liv·ing thing (**liv**-ing **thing**) *noun* — Organism that is alive, needs air, food, water, shelter and space to survive, and is able to reproduce or create more of itself.

mi·cro·or·gan·ism (mye-kroh-**or**-guh-niz-uhm) *noun* — A living thing that is too small to be seen without a microscope.

mi·grate (**mye**-grate) *verb* — To move at a particular time of year from one region or climate to another.

mi·gra·tion (mye-**gray**-shun) *noun* — The act of organisms moving at a particular time of year from one region or climate to another.

mi·gra·tor·y (**mye**-gruh-tor-ee) *adjective* — Traveling from one place to another at regular times of the year, often over long distances.

noc·tur·nal (nok-**tur**-nuhl) *adjective* — An animal that is active at night.

non-liv·ing thing (**non**-liv-ing **thing**) *noun* — Something that is not alive and is not able to grow or reproduce to make more of itself.

nu·tri·ent (**noo**-tree-uhnt) *noun* — Something that is needed by organisms to stay healthy and alive.

nymph (**nimf**) *noun* — The young form of an insect, such as a grasshopper, that changes into an adult by repeatedly shedding its skin.

om·ni·vore (**om**-nuh-vor) *noun* — An animal that eats both plants and animals.

or·gan·ism (**or**-guh-niz-uhm) *noun* — An individual living thing, such as a plant, animal or fungus, that is able to grow and reproduce.

ox·bow (**oks**-boh) *noun* — A pond formed when a bend of a stream or river becomes cut off from the main channel.

poach·er (**pohch**-ur) *noun* — A person who hunts or fishes illegally.

pol·len (**pol**-uhn) *noun* — Tiny yellow grains produced by flowers.

pol·len bas·kets (**pol**-uhn **bass**-kitz) *noun* — Specialized structures on the hind legs of honey bees, bumblebees, stingless bees and orchid bees that store pollen packed into it by the bee.

pol·li·nate (**pol**-uh-nate) *verb* — To carry or transfer pollen from the male part of a flower to another flower where the female part can be fertilized to produce seeds.

pol·li·na·tor (**pol**-uh-na-tur) *noun* — Anything that carries or transfers pollen from one flower part to another.

pond (**pond**) *noun* — An enclosed body of fresh water.

pond e·co·sys·tem (**pond ee**-koh-siss-tuhm) *noun* — All the living and non-living things interacting in a pond environment.

pool (**pool**) *noun* — A small area of still water.

pop·u·la·tion (pop-yuh-**lay**-shuhn) *noun* — A group of the same organisms living together in the same place and at the same time.

prair·ie (**prair**-ee) *noun* — A large area of flat or rolling grassland with wildflowers but with few, if any, woody shrubs or trees.

prair·ie e·co·sys·tem (prair-ee **ee**-koh-siss-tuhm or **ek**-oh-siss-tuhm) *noun* — All the living and non-living things interacting in a prairie environment.

pred·a·tor (**pred**-uh-tur) *noun* — An animal that lives by hunting other animals for food.

prey (**pray**) — 1. *noun:* An animal that is hunted by another animal for food. 2. *verb:* When an animal hunts and eats another animal.

pro·duc·er (**pruh**-dooss-ur) *noun* — A plant that makes its own food using energy from the sun.

re·pro·duce (ree-pruh-**dooss**) *verb* — To produce another living thing of the same kind; to produce offspring.

rhi·zome (**rye**-zohm) *noun* — A plant stem that grows horizontally under or along the ground and often sends out roots and shoots. New plants develop from the shoots.

rif·fle (**rif**-uhl) *noun* — Bubbly sections of shallow streams that appear as white water where the streams flow over rocks. These bubbly sections add oxygen to the water.

ri·par·i·an zone (rye-**pair**-ee-uhn **zohn**) *noun* — A parallel section of trees, shrubs, grasses and other plants along streambanks.

sa·van·na (suh-**van**-uh) *noun* — Flat, grassy plain with few scattered trees.

scat (**skat**) *noun* — Animal waste; feces; droppings.

scav·en·ger (**skav**-uhn-jur) *noun* — An animal that lives on dead and decaying organisms.

soil (**soyl**) *noun* — Dirt or earth in which plants grow. Soil parts contain water, air, small bits of dead plants and animals and living things too small to see without a microscope.

spe·cial·ized struc·ture (**spesh**-uh-lizd **struhk**-chur) *noun* — Plant or animal part that helps an organism survive in its specific environment.

stream (**streem**) *noun* — A body of flowing water, especially a brook or a small river.

Stream Teams (**streem teemz**) *noun* — Groups of people who volunteer to adopt sections of Missouri rivers, streams and creeks to monitor the quality of the water and the organisms that live in it.

swim blad·der (**swim blad**-ur) *noun* — An air-filled sac in many fish that helps maintain buoyancy and keeps fish from sinking to the bottom of the water.

ul·tra·son·ic (uhl-truh-**son**-ik) *adjective* — Describes sound vibrations and frequencies too high for the human ear to hear.

un·der·sto·ry (uhn-dur-**stor**-ee) *noun* — The middle layer of a forest consisting of smaller trees, seedlings of the canopy's trees, shrubs and vines that have adapted to the canopy's shade.

veg·e·tar·i·an (vej-uh-**ter**-ee-uhn) *noun* — A person who eats only plants and vegetables.

ven·om (**ven**-uhm) *noun* — Poison produced by some snakes and spiders and usually passed into a victim's body through a bite or sting.

wa·ter·fowl (**waw**-tur-foul) *noun* — 1. A bird that is found in or near water 2. *plural:* birds with webbed feet of the family including ducks, geese and swans; especially wild ducks and geese hunted as game.

wa·ter·shed (**waw**-tur-shed) *noun* — Region or land area that drains into a river or lake.

wet·land (**wet**-land or **wet**-luhnd) *noun* — Land that has much moisture in it and that stays wet for at least part of the year such as swamps, bogs, marshes and fens.


Coyote

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